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AMERICAN DYESTUFF REPORTER

MBER 23, 1940
UME 29, No. 26

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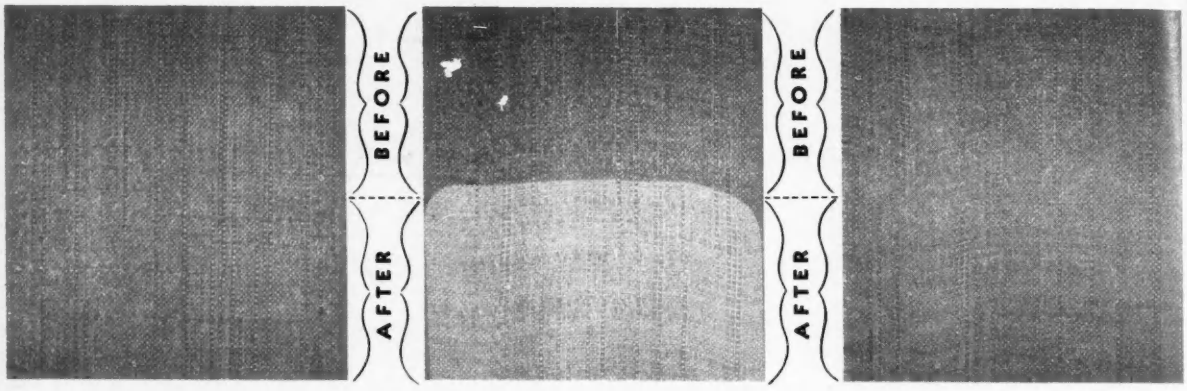

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DECEMBER 23, 1940

VOLUME 29 NUMBER 26

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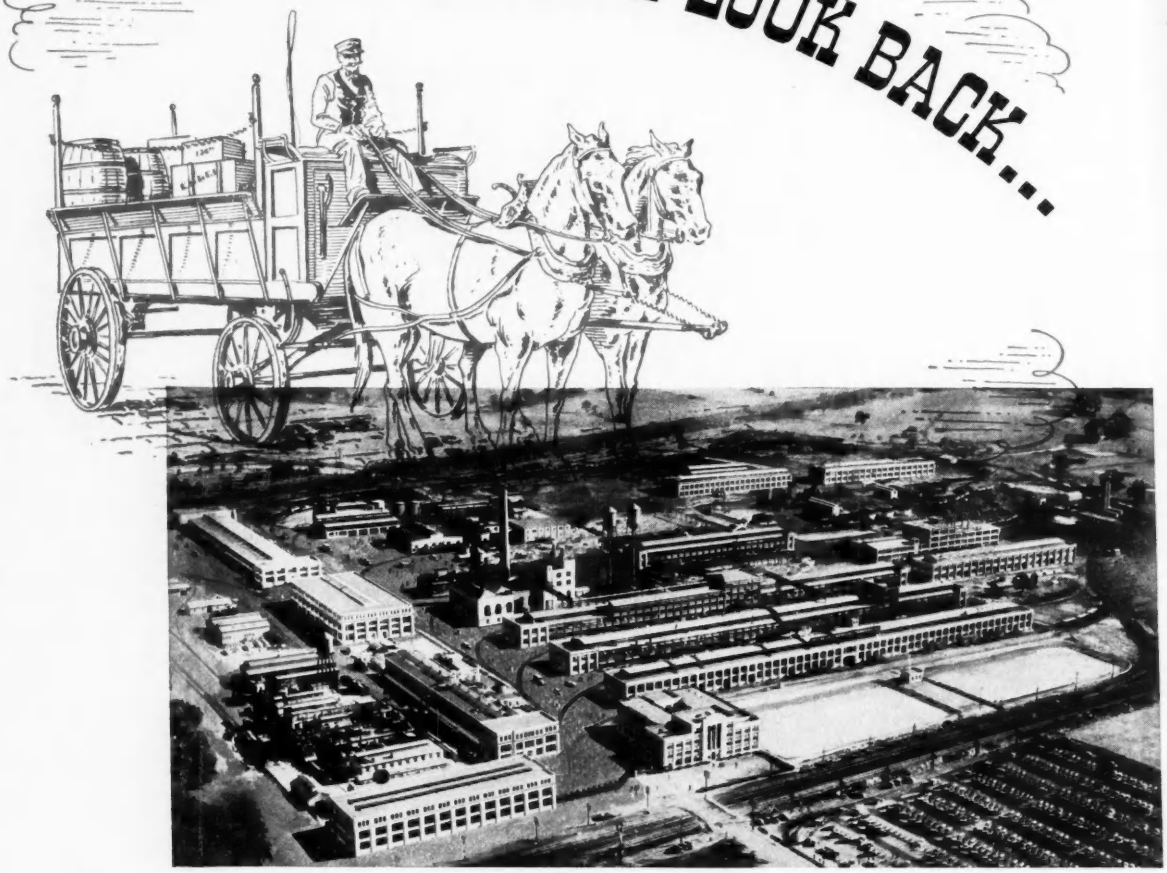
AS WE LOOK BACK...



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CALENDAR OF COMING EVENTS

Meeting, South Central Section, Read House, Chattanooga, Tenn., February 8, 1941.

Annual Meeting and Convention, Carolina Hotel, Pinehurst, N. C., Oct. 31, Nov. 1, 1941.

1st PRIZE
Winner of the Intersectional Contest

The Effect of Modern Finishing Agents on the

Light Fastness of Cotton Colors*

THE fact that finishing compounds often have an effect on the fastness of dyes to light has been known for many years. At various times Jones[1], Hannay[2], Schmidt and Gabler[3], Brown[4], and others have investigated the effect on light fastness of the various substances ordinarily employed in finishing, and all are agreed that in general, dextrine, glucose and starch have a beneficial action, while soluble oils as a rule accelerate the fading. These effects, however, are relatively slight.

When urea-formaldehyde resins began to be used for crease resistance, a few years ago, it was soon noticed that certain dyes, particularly Direct Blues and Greens, when treated with these resins became much more sensitive to light, while other dyes similarly treated were either unaffected or in some cases actually improved. These phenomena are extremely interesting from a scientific standpoint (though frequently very annoying to the dyer), and deserve careful investigation, but they will not be discussed further in this paper.

About six years ago a new family of finishing materials made its appearance in the textile market, known collectively as "cation active compounds," from the circumstance that the active radicle in each one of them is the cation; in other words, it carries a positive charge. In this respect these compounds differ from such substances as soap and sulfonated oils and alcohols, which are all "anion active." It is not the intention of the writer to go into particulars regarding the application of the cation active compounds to textiles, as they are already well known. They are a very versatile group and have many uses. Some are employed to increase the fastness of Direct dyes to water and perspiration, or to produce semi-permanent softness. Some of them will assist in the hydrosulfite stripping of Vat dyes, and when added to a basic dyebath, will retard the rate of dyeing. Bertsch[5] has also found a use for them in the pigment padding of Vat dyes. But it seems to have been generally overlooked that many of these products, when applied to fabrics dyed with Direct dyes, have the curious effect of accelerating the light fading of these dyes to a remarkable degree. The writer has searched the technical literature, but has failed to find a single article in which this increased fading is mentioned.

The advisory committee in charge of the Rhode Island Section's participation in this contest, in seeking a suitable subject for a paper, agreed that no better one could be selected than the phenomenon which has just been mentioned. We therefore drew up a program of experimental work which we hoped would furnish the answers to some of the following questions:

What cation active compounds affect the light fastness of Direct Dyes?

What Direct dyes are affected: and what other dyes, if any?

Under what conditions is the effect most pronounced?

What is the actual reaction between the cation active compound and the dye, and what effect if any does the fiber have on this reaction?

Can the accelerated fading be prevented without impairing the other properties of the cation active substance?

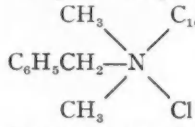
At the outset, it was decided that it would be unwise to employ any of the commercial compounds in this investigation, partly because of their doubtful purity and homogeneity, partly because of the unwillingness of most of the manufacturers to divulge the chemical constitution of their products, and partly because it seemed best to omit all reference to trade names and employ only the chemical nomenclature.

With the co-operation of the Röhm & Haas Company, the DuPont Company, and the Warwick Chemical Company, nineteen samples of cation active compounds of known constitution, all reasonably pure, were assembled. The full list of these products is shown on the chart (table 1). It will be noticed that Products Nos. 1 to 8 are quaternary ammonium compounds, Nos. 4 and 5 containing a pyridine ring. Nos. 9 to 19 may be termed trivalent nitrogen compounds. This list is by no means complete, as many more substances having similar properties might have been added (for example the phosphonium and sulfonium compounds), but we believe that the nineteen samples offer sufficient variety for this particular investigation. It will be observed that some compounds have one and some two fatty chains; some have chlorine or bromine as the anion, while others have the acetate group. Some have a single Nitrogen atom while others have as many as five nitrogens. A few have hydroxyl groups. All of these differences probably contribute to the effect of the several compounds on the dyes; thus, as will be seen later, Nos. 1 to 8 have much more

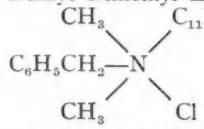
*Presented by the Rhode Island Section at the Intersectional Contest, Annual Meeting, October 18, 1940, New York, N. Y.

TABLE 1
Cation Active Compounds

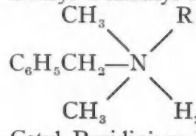
1. Benzyl Dimethyl Cetyl Ammonium Chloride



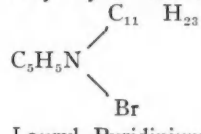
2. Benzyl Dimethyl Lauryl Ammonium Chloride



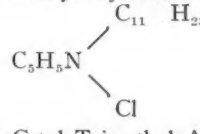
3. Benzyl Dimethyl Alkyl Ammonium Phosphate



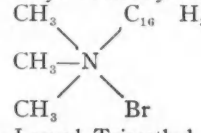
4. Cetyl Pyridinium Bromide



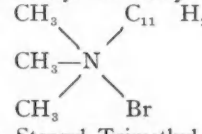
5. Lauryl Pyridinium Chloride



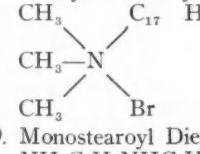
6. Cetyl Trimethyl Ammonium Bromide



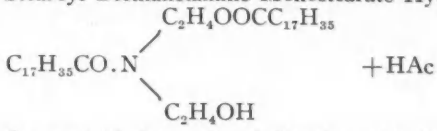
7. Lauryl Trimethyl Ammonium Bromide



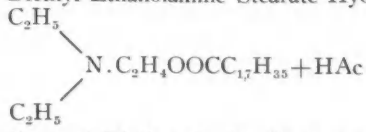
8. Stearyl Trimethyl Ammonium Bromide



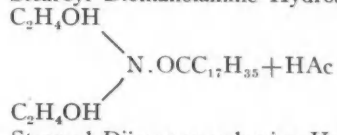
9. Monostearoyl Diethylene Triamine Hydroacetate
$NH_2C_2H_4NHC_2H_4NH.OCC_{17}H_{35}+HAc$
10. Distearoyl Diethylene Triamine Hydroacetate
$C_{17}H_{35}CO.NHC_2H_4NHC_2H_4NH.OCC_{17}H_{35}+HAc$
11. Monostearoyl Triethylene Tetramine Hydroacetate
$NH_2C_2H_4NHC_2H_4NHC_2H_4NH.OCC_{17}H_{35}+HAc$
12. Distearoyl Triethylene Tetramine Hydroacetate
$C_{17}H_{35}CO.NHC_2H_4NHC_2H_4NHC_2H_4NH.OCC_{17}H_{35}+HAc$
13. Monostearoyl Tetraethylene Pentamine Hydroacetate
$NH_2C_2H_4NHC_2H_4NHC_2H_4NHC_2H_4NH.OCC_{17}H_{35}+HAc$
14. Distearoyl Tetraethylene Pentamine Hydroacetate
$C_{17}H_{35}CO.NHC_2H_4NHC_2H_4NHC_2H_4NHC_2H_4NH.OCC_{17}H_{35}+HAc$
15. Stearoyl Diethanolamine Monostearate Hydroacetate



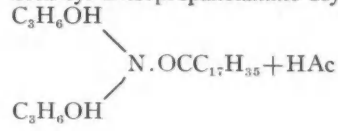
16. Stearoyl Hydroxy Ethyl Ethylene Diamine Stearate Hydroacetate
$C_{17}H_{35}CO.NHC_2H_4NHC_2H_4OOCC_{17}H_{35}+HAc$
17. Diethyl Ethanolamine Stearate Hydroacetate



18. Stearoyl Diethanolamine Hydroacetate



19. Stearoyl Diisopropanolamine Hydroacetate



effect on the light fastness (the application being the same) than Nos. 15 to 19, the others being intermediate. Much more work will have to be done before all of these contributing factors can be analyzed and their relative importance determined.

According to Chwala,[6] whose four-page article in the Textilberichte is well worth reading, the reaction between cation active compound and Direct dye is a salt formation. If we assume for the moment that the dye has only a single sulfonic acid group, linked to sodium, and that the cation active substance has a single atom of chlorine for an anion, then on combining the two, a chemical union of the two substances takes place at those points, and sodium chloride is formed at the same time.

For the purposes of this investigation five Direct dyes were selected, the constitutions of which are known, and all of which have one or more sulfonic acid groups. They will be referred to as follows:

1.	Blue 4GL	C. I. 533
2.	Sky Blue 6B	C. I. 518
3.	Red 8BL	C. I. 278
4.	Violet 2B	C. I. 471
5.	Green BX	C. I. 593

The fabric employed in most of our experiments was a spun rayon twill, (though as will be seen later, cotton would probably have given similar results). One per cent dyeings of the five dyes were made on a large scale, and

portions were treated with all of the nineteen cation active compounds, and exposed to the Fadeometer, together with untreated samples, for 15 hours. It should be explained at this point that preliminary experiments with product No. 1 (on the chart) had shown that there are three factors which affect the reaction between cation active compound and dye: concentration, time and temperature. Thus, if the compound is merely padded on the fabric either cold or hot, and dried at once, relatively little fading takes place, but if the temperature is maintained, say at 160° for an hour, the fading effect is greatly increased. In general, immersing the fabric in a solution of the compound was more effective than padding the solution on the fabric. Ultimately we settled on the following standard treatment: we immersed the dyed fabric in a solution of the compound containing 2 per cent (on the weight of cloth), starting at 120° and heating to 160° for 15 minutes, then squeezing and drying. With a few exceptions this method was used in all our experiments.

The result of the tests on the five dyes showed that there is a very positive fading action on all of these dyes when treated with most of the cation active compounds used and exposed to light. It should be noted that the products which cause the greatest fading frequently produce another effect as well: they alter the shade of the dyeing to a marked degree, as we will try to show later. In general the new shade is fuller and brighter than the original one, and in some cases an entirely different shade is produced. Probably the great increase in the size of the dye molecule by the addition of the cation active compounds is responsible for these changes in shade and depth.

While all of the five dyes employed in these tests did not show the same total acceleration in fading (the greatest effect being shown by Blue 4GL and Red 8BL, which are unusually fast to light in their normal state) it may be said that the five dyes showed a marked similarity in the relative fading produced by the 19 different cation active compounds. Further tests made with several other Direct dyes, treated with Product No. 1 (on the chart), gave similar results and seem to justify the conclusion that practically all Direct dyes may be expected to fade more rapidly with this treatment. Diazotized and developed dyes show the same effect, so far as we have investigated them, though a higher concentration of compound is sometimes necessary. On the other hand, the insoluble azo colors are practically unaffected. This is probably explained by the absence of any sulfonic acid groups in these dyes. Vat colors of the Anthraquinone type also appear to be immune, but the Indigoids are definitely attacked. Sulfur colors also seem to be somewhat affected.

Attempts were made to break up the combination of dye and cation active compound on the fiber in order to remove the latter and restore the dye to its original light fastness. These experiments were not very successful. Extraction with Stoddard solvent, ether, alcohol, and benzol, and treatment with hot soap and hot dilute hydrochloric acid were all tried and failed to restore the light fastness. Further investigation along this line would be helpful.

An experiment was made to determine what effect the addition of an anion active compound to the cation active compound would have on the light fastness, and whether it would affect the fastness to water as well. A dyeing of 1 per cent Blue 4GL was treated in five ways:

Cetyl Sodium Sulfate alone.

Product No. 1 with an excess of Cetyl Sodium Sulfate.

Product No. 1 just neutralized with Cetyl Sodium Sulfate.

Product No. 1 with insufficient Cetyl Sodium Sulfate to neutralize.

Product No. 1 alone.

These samples were exposed to light and also treated for 24 hours in cold water in contact with white cotton. In the light test, the sample treated with No. 1 alone was completely faded, the others only slightly. In the water test, not only the sample treated with No. 1 alone but also the one with No. 1 and insufficient Cetyl Sodium Sulfate, left white cotton unstained: the other three stained the white badly. In other words, the addition of a little anion active compound, while improving the light fastness, has not interfered with the water fastness. Lack of time has prevented our following up this line of investigation, but it looks promising.

A few experiments were made with other fibers to determine if the fading action of these compounds is the same on all. Wool, mercerized and unmercerized cotton, spun viscose rayon and saponified acetate rayon were all treated with Product No. 1 and exposed alike. All showed similar fading. Also a comparison was made of sun and Fadeometer fading on a cotton dyeing of 1 per cent Blue 4GL treated with No. 1. The relative fastness of the treated and untreated samples was approximately the same in both sun and Fadeometer tests. Incidentally, the sun-faded samples, treated and untreated, were tested for tensile strength and found approximately equal, indicating that the abnormal fading caused by the cation active treatment is apparently not accompanied by tendering of the fiber.

We will not attempt to suggest a theory to explain the abnormal fading which has been described, but hope that the results of this investigation will stimulate others to carry on the work and ultimately discover the true cause, and perhaps a remedy.

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[1]J. Soc. Dyers & Col., *26*, 147 (1910).
[2]Ibid. *28*, 20 (1912).
[3]Ibid. *30*, 236 (1914).
[4]Ibid. *53*, 90 (1937).
[5]Angew. Chem. *48*, 52 (1935).
[6]Textilber. *17*, 583 (1936).

NOTE:—This paper was also presented at the meeting of the Northern New England Section on December 20th. The discussion which followed, as well as a number of other comments, will be published at an early date.—Ed.

Technical Evaluation of

Textile Finishing Treatments

V. Comparison of the Stiffness of a Cotton Fabric Given Different Treatments and Finishes

LELIA J. WINN* and EDWARD R. SCHWARZ, F.T.I.**

ABSTRACT

A quantitative comparison is made between the Schiefer Flexometer, Gurley Stiffness Tester, Peirce Hanging Loop test and the Drapeometer in which it is pointed out that the last two of the foregoing methods possess the merits of sensitivity, simplicity, low initial cost of apparatus and duplication of results. The factors inherent to the specimen are shown to be possible of investigation by the proper combination of several test methods. Further uses of rank correlation and application of the analysis of variance are made.

PREVIOUS papers in this series have been largely concerned with the nature of the properties it was desired to measure; the types of apparatus available; and the mathematical techniques required for adequate analysis of the data. In large measure, therefore, they have been introductory. The present discussion deals with the application of the techniques previously discussed to data obtained on the several instruments described[4].

A limited range of materials and treatments was investigated and the following paragraphs are intended to act as a guide for further work by ourselves and other investigators on additional fabrics subjected to these and other treatments. An important object of the present study is to stimulate interest in the simplified techniques which have been developed and to foster wider interest in the subject so that a number of investigators may work on various aspects of the problem in coordinated fashion.

A cotton material used in making tag cloth was selected for the tests. Three sections of this material were given separate treatments, namely Tag, Heavy, and Medium. Each section was then subdivided into four others and given separate finishes, Calendered, Friction Calendered, Sprinkled and Calendered, and Calendered over Bar. Thus twelve treated materials and one untreated material were tested in all. The specimens were taken from the materials in as random a manner as possible. Each material was divided into five sections. A specimen for each test method was taken from each section in such a manner that the specimens of one section had different warp and filling threads from the specimens in every other section. The additional variation of filling tests was eliminated by testing only in the warp direction. If it had been possible to take all the specimens from the same set of warp threads this would have eliminated the warp variation better than taking random samples. The specimens were tested on the face and on the back so as to show the sensitivity of the instrument to such small differences. The average of the front and back reading was taken as the stiffness reading for the specimen. The average of the five specimens shows the stiffness value for that material.

The methods used to test the samples of the present discussion were the Drapeometer[1], the Heart Loop of Peirce[2], the Schiefer Flexometer[3], and the Gurley Stiffness Tester[4]. Tests were also conducted by Messrs. Shapiro and Durand of the Interlaken Mills, in cooperation with the authors, on the Interlaken Tester, which agreed with the readings of the Flexural Rigidity of the Heart Loop. The Interlaken Tester measured the rotation (about a trunion axis through one end of the sample) required to exert a force of 0.5 gram on the other end of a 2″ x 2″ cantilever sample.

TABLE IA

	Weight mg. cm.²	*Thickness cms.*	*Density mg. cm.³*
1. Heavy Mix Plain Calender	12.40	.0203	611
2. Heavy Mix Friction Calendered.	12.68	.0152	834
3. Heavy Mix Sprinkled and Calendered	12.50	.0203	616
4. Heavy Mix Calendered over Bar	12.52	.0203	617
5. Medium Mix Plain Calender ..	11.48	.0203	566
6. Medium Mix Friction Calendered	11.49	.0152	756
7. Medium Mix Sprinkled and Calendered	11.49	.0191	602
8. Medium Mix Calendered over Bar	11.47	.0203	565
9. Tag Finish Regular	13.82	.0254	544
10. Tag Finish Friction Calendered.	13.63	.0178	766
11. Tag Finish Sprinkled and Calendered	13.48	.0203	664
12. Tag Finish Button Breaker, Broken over Bar.....	13.69	.0229	598
13. Untreated and Unfinished Material	10.67	.0292	365

The Drapeometer offers a rapid method of testing which gives a graphic record as the test is made. The specimens, 4.7″ x 10″, are cut with the aid of a template. Each

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specimen may be tested on both sides to give an average stiffness value and after a further period of rest they may be given a check retest. In these tests the specimen was attached to the drape disc and after it had hung for an arbitrary ten-minute period the chord length was measured at intervals down from the top free edge. A plot was drawn of length versus height to give the complete chord length story, but this is not necessary for routine tests. A single measurement at a determined height is sufficient. The new Drapeometer can measure more indications of stiffness than the chord length and these are now being investigated. In the tests made on the cotton materials each test took ten minutes so one hundred minutes was needed for each material to give a total testing time of twenty-one and two-thirds hours for the thirteen materials. If five discs were used in relays and the specimens were attached to the discs at two-minute intervals and read in turn after hanging for the ten-minute period, the time could be cut to eight and two-thirds hours. The chord length at the given height is read on the tester and no further calculations are necessary.

Thus Sample 1, Material 1
Face in... 3.87
Face out... 4.23

Average = 4.05 inches which is the stiffness value.

When samples of widely different flexibility are compared, a standard level at which to measure the chord length must be determined. Since the curves of length versus height do not cross (See Fig. 5—Ref. 4), the stiffness order of the samples is not changed from one level to another. However differences in flexibility show more clearly at some levels than at others. The chord length spreads from 3″ at the zero top line to a higher value near the bottom edge. A very pliable specimen shows nearly the same rate of flare from top to bottom, but a very stiff specimen quickly flares to almost a straight line about halfway down its length, and below this point it changes very little. Thus a level too near the top edge will not show much variation between pliable samples because they have not begun to flare, while a level too near the bottom edge will not show differences in stiff specimens, which reached a maximum flare above that level. An intermediate level must be chosen, and, as indicated above, it was set at 4″ down from the top free edge of the specimen. However later tests have shown that 4″ to 7″ or 8″ is possible for optimum readings.

In many cases tests are not made on a wide range of samples, but rather on a group which show only small differences in flexibility. The importance of the analysis of variance technique in such tests have been explained. It may also be used to determine the most efficient level at which to measure samples of a given flexibility range.

In the tests under discussion for this range of fabrics the chord lengths for each specimen were found at the 4, 5, 6, 6½, 7 and 8 inch levels. An analysis of variance was run for each level. It was found that as the measurements were made further down the specimen, the range of values increases slightly. At the same time the variation of the specimens within a sample decreased, so that the differences between samples became more measurable. The variation within decreased to the level where the bending force at the top diminished so that its influence was not enough to hold the specimen against the skew forces within itself, and at this level the variation started to increase. This fact is shown by the changes of the variations within for the three treatments. The stiffer Tag treatment shows a variation within increase after the 6″ level, the Medium treatment shows no increase until the 8″ level, while the more pliable Heavy treatment shows no increase at the lowest level measured.

It was found that the 7″ level allowed the most efficient comparison for the range of stiffnesses covered in these tests. At this level the smallest significant difference is .060, as compared to .068 at the 4″ level. The variation between samples is less below the 7″ level because the specimens have lost the greater amount of their initial curvature, and skew forces near the bottom edge may appear to change the values. At the 7″ level there are 7 different significant samples, as compared to the 5 which may be shown at the 4″ level, or the 6 at the other levels. (See Table IB.)

TABLE IB

Material No.	*Chord Length as Measured at the Different Levels* 4″	5″	6″	6½″	7″	8″
13	4.23	4.38	4.49	4.53	4.55	4.59
12	3.91	4.04	4.16	4.20	4.24	4.31
9	3.86	3.98	4.09	4.14	4.18	4.27
11	3.76	3.93	4.01	4.05	4.08	4.16
7	3.77	3.90	3.99	4.04	4.07	4.15
5	3.76	3.88	3.98	4.02	4.06	4.14
10	3.74	3.87	3.96	4.01	4.04	4.12
1	3.72	3.86	3.96	4.00	4.03	4.11
8	3.72	3.84	3.94	3.98	4.03	4.09
3	3.71	3.83	3.94	3.98	4.02	4.10
4	3.69	3.81	3.91	3.96	4.00	4.08
6	3.65	3.75	3.85	3.89	3.94	4.00
2	3.59	3.71	3.80	3.84	3.88	3.94
Range	.32	.33	.36	.36	.36	.37
Smallest Significant Difference Between Values	.068	.063	.062	.062	.060	.060
Number of Significantly Different Stiffness Values	5	6	6	6	7	6
Variation Within Treatments						
Tag	.0819	.0762	.0740	.0769	.0759	.0724
Medium	.0389	.0292	.0261	.0249	.0188	.0219
Heavy	.0170	.0168	.0167	.0150	.0148	.0144
	.1378	.1222	.1168	.1168	.1095	.1087

When a more pliable range of fabrics is compared, such as a set of cotton percales, a lower level might prove to be more efficient. The stiffer fabrics should be measured at a higher level. Further tests may indicate the correct level for fabrics of a given flexibility.

The Hanging Heart Loop test gives results that are

comparable to the stiffness as measured by the fingers. The apparatus is a horizontal bar and a cathetometer. The specimens in the cotton cloth tests were cut (25″ + 1″) x 1″ because of their stiffness and took a longer time to prepare than the drape test specimens. The loops are hung in relays as suggested above so that the total testing time was 40 minutes x 13 = 8-2/3 hours. However, the readings taken during the tests are not comparable as stiffness values unless the loops are cut the same length and the weight of the sample is not taken into account. Tables of c and G for a given length L and weight W may be prepared for routine use.

Thus to correct for the weight of the sample we must find c and then $G = wc^3$. A quantity "q" (the bending modulus) takes the thickness of the material into account and is $\frac{12G}{d^3 10^6}$

$$c = L \times 0.133\, f_2\theta$$

when L = total length of the specimen in cms.

l = actual length of loop under its own weight.

$f_2\theta$ is read from a table of values of θ

$$\theta = 32.85 \frac{d}{lo}$$

$$lo = .1337L$$

$$d = l - lo$$

Thus Sample 1, Material 1

	Cathetometer Readings	
	Face Out	*Face In*
Top Reading	34.90	34.45
Bottom Reading	11.22	11.06
	l = 23.68	23.39

Average l = 23.54

$L = 25 \times 2.54 = 63.50$ cms.

$lo = .1337 \times 63.50 = 8.49$

$d = 23.54 - 8.49 = 15.05$

$$\theta = 32.85 \times \frac{15.05}{8.49} = 58.23$$

$f_2\theta = .692$ for $2\theta = 58$ .676 for $\theta = 59$ .688 for $\theta = 58.23$

$c = 63.50 \times .133 \times .688 = 5.81$ cm.

$G = 12.40 \times 196.12 = 2432$ mg. cm. which is the stiffness value.

$$q = \frac{2432 \times 12}{(.0203)^3 10^6} = \frac{29184}{8} = 3648 \text{ kg. cm.}^2$$

The Schiefer Flexometer gives results very like those of the rigidity (G) although the influence of the weight and thickness of the specimens makes some small differences. Each test uses two specimens which are permanently creased and cannot be retested. Thus twenty rectangles 1¾″ x 4″ were cut for each material. Each test took ten minutes so as to correspond in time with the other tests making a total of 21-2/3 hours. However, the strain on the material is much greater because the crease is much sharper than the bend in the other methods. The readings are not comparable unless the materials are of the same thickness and the same strength of spring has been used. Otherwise they must be referred to a calibration curve and the force values used.

Thus for Sample 1A and 1B of Material 1:

The angle β to which the specimens were creased is equal to 430 times the thickness in inches to the nearest .5 degree.

$$\beta = 430 \times .008 = 3.5°$$

At angle β the top pointer reading was

Face in = 80.5°

Face out = 79.5°

Average = 80.0°

The bottom pointer reads 97.5° at angle β.

Since Spring No. 7 was used and its deflection is equal to 5° minus the difference between the top and bottom pointer readings

$$5° - (80° - 97.5°) = 22.5°$$

From the calibration chart it is seen that 22.5° deflection of Spring No. 7 is caused by 113.5 grams.

113.5 grams is the stiffness value

The Gurley Stiffness Tester results are also comparable to those of the rigidity (G), but they are more influenced by weight and thickness variations than are the Schiefer Flexometer results. The specimens for these tests were cut 1″ x 3½″. Five readings were taken alternately on each side of the scale and the specimen was then reversed as to side and top position and retested. Each specimen thus gave ten readings for each side. The average of these readings is a better value than a single reading and the test is rapid enough so that they may be taken in a short time. Each specimen test took two minutes to give a total time of 2-1/6 hours. The average of the readings must be multiplied by a factor which is determined by the size of the sample and the size and position of the weight on the vane.

Thus for Sample 1, Material 1

When a specimen 3½″ x 1″ is tested with a 5 gram weight 1 inch from the center point of the vane, the factor equals 100.

	Side I Bent In *Scale Reading on Left*	*Side I Bent Out* *Scale Reading on Right*
Sample right side up	5.8 5.9 5.9 5.8 5.7	3.2 3.2 3.2 3.3 3.3
	Scale Reading on Right	*Scale Reading on Left*
Sample other side up	3.6 3.4 3.6 3.6 3.4	6.0 6.0 6.0 5.9 6.0
	Av. = 4.67	Av. = 4.61

Specimen Average = 4.64

$4.64 \times 100 = 464$ mg. which is the stiffness value.

When the tests by each method had been completed the stiffness values were used in an analysis of variance[4] to determine whether the different treatments and finishes had significantly different effects on the stiffness of the material. Every method of testing indicated this as true. The variance within the materials was used in the t-test[4]

to determine the smallest significant difference between the average stiffness of two materials as measured by each method. This difference is given below the stiffness orders in Table VI. From it we can find the number of significantly different stiffness values of these materials given by each test method when 5 specimens are tested. This is a measure of the sensitivity of the method on this type of material.

TABLE II

Test Method	*Number of Different Values*
Schiefer Flexometer	6
Drapeometer	7
Heart Loop	7
Gurley Stiffness Tester	9

The Schiefer Flexometer tests gave six significantly different stiffness values for thirteen materials, or 46 per cent of the total values. This method uses two specimens for each test, and a different pair was used for the face than for the back readings of the materials. Thus the larger number of specimens gave closer stiffness averages than would otherwise have been obtained by this method. The Drapeometer tests showed more sensitive with seven different values, and only one set of specimens was needed. The Hanging Heart Loop tests also gave seven significantly different stiffness values, or 54 per cent of the total. The Gurley Stiffness Tester tests gave nine significantly different stiffness values, or 69 per cent of the total. However, five times as many readings were taken of each specimen so that the average was closer to the true value of each specimen. The papery nature of these fabrics under test made stiffness values more easily measured by this method.

The four methods do not entirely agree on the variation of each treatment and finish within itself and from the others as is shown in Table III. The Drapeometer and bending length (c) are the only methods which do not vary from order of the majority. The Tag treatments show the most variation within the averages of each material in the Heart Loop, Gurley Flexometer and Drape methods, but the Medium treatment shows the most variation within the Schiefer Flexometer method. The Heavy treatment shows the least variation within, except for the rigidity (G). The Tag treatment also shows the most variation between the averages of the materials in the groups for all four methods. The Medium treatment shows the least variation between for the Heart Loop and Drapeometer methods, although it is close to the Heavy treatment which shows the least variation between for the Schiefer Flexometer and Gurley Flexometer methods.

The Calendered over Bar finish shows the most variation within for all the methods and the Calendered finish shows the least variation except for the rigidity (G) and Gurley Flexometer which show the Friction Calendered finish as the least variable within. There is little agreement by the three methods as to the variance between finishes.

TABLE III
Estimates of Variance

Variation Within Treatments	*Heart Loop* c	*Heart Loop* G	*Drape*	*Schiefer Flexometer*	*Gurley*
Tag	.4033	742,787.6	.0759	192.9	1.0426
Medium .	.2518	181,794.4	.0188	463.1	.8317
Heavy ..	.2034	276,720.8	.0148	90.4	.5134
Variation Between Treatments					
Tag	2.8766	6,474,092.2	.1206	990.1	5.5785
Heavy ..	.7417	880,558.1	.0723	308.1	.9659
Medium .	.6904	541,416.5	.0543	828.6	1.6652

TABLE IV
Estimates of Variance

Variation Within Finishes	*Heart Loop* c	*Heart Loop* G	*Drape*	*Schiefer Flexometer*	*Gurley*
Calendered over Bar .	.5535	663,226.8	.0566	292.7	.9226
Sprinkled & Calendered.	.1158	208,989.1	.0153	140.5	.7113
Friction Calendered.	.1102	146,652.0	.0254	189.6	.2958
Plain Calendered.	.0806	182,434.8	.0122	123.6	.5801
Variation Between Finishes					
Calendered.	3.4469	10,596,345.6	.0624	1,128.6	5.0924
Friction Calendered.	1.9873	3,925,790.4	.0674	841.9	11.3458
Sprinkled & Calendered.	.6002	4,143,518.5	.0109	2,719.6	8.6849
Calendered over Bar .	.9890	2,048,590.8	.1704	1,912.2	4.9862

The Schiefer Flexometer uses a different set of samples to test the stiffness of each side and it does not show the small difference which exists between them. The other methods showed that when the face, the smoother side which was on the inside of the rolled lengths as they were received, is on the inside of the curve to which the material is bent, the readings are stiffer. The Hanging Heart Loop test gave reverse results but if c is found by a cantilever strip[2] rather than by calculation from l, it agrees with the Drapeometer and Gurley Stiffness Tester methods. The methods show that the untreated material has the least difference between the two sides. Thus the finishes and the treatments make the difference greater. The amount of difference in the Heart Loop tests seems to be in the reverse order to those of the Drapeometer and Gurley Flexometer. The Schiefer Flexometer, as mentioned above, shows no consistent variation.

When the analysis of variance was made the stiffness values were arranged in the order of decreasing stiffness.

A stiffness ranking for each method was determined by the stiffness values given in Table VI.

The methods measure a common factor, stiffness, so that we would expect correlation in the test results. Since factors such as specimen weight and thickness have a different

TABLE VI

Material Number	Heart Loop c cms.	Heart Loop G mg./cms.	c kgm./cm.^{3}	Schiefer Flexometer Grams	Drapeometer Inches	Gurley Stiffness Tester mgs.
	9. 6.47	9. 3743	2. 6940	11. 136.5	13. 4.55	9. 586
	11. 6.01	11. 2926	10. 5455	12. 136.0	12. 4.24	11. 536
	1. 5.88	10. 2564	6. 4482	10. 133.0	9. 4.18	10. 507
	3. 5.88	3. 2541	11. 4195	2. 119.5	11. 4.08	1. 477
	10. 5.73	1. 2521	3. 3643	9. 119.0	7. 4.07	3. 472
	4. 5.60	12. 2216	1. 3614	1. 115.5	5. 4.06	4. 449
	12. 5.45	4. 2199	4. 3153	6. 115.0	10. 4.04	12. 440
	2. 5.43	2. 2030	7. 2879	4. 112.0	1. 4.03	2. 404
	5. 5.30	5. 1709	9. 2740	8. 112.0	8. 4.03	7. 352
	7. 5.26	7. 1672	5. 2450	3. 109.0	3. 4.02	5. 341
	8. 5.00	8. 1434	12. 2216	7. 107.0	4. 4.00	8. 322
	6. 4.85	6. 1311	8. 2056	5. 98.0	6. 3.94	6. 294
	13. 2.11	13. 100	13. 48	13. 21.0	2. 3.88	13. 111
Significant Difference (for Pairs of Values[4])	.16	200		5.0	.06	29

TABLE V

Average Difference Between Sides

Treatments	of Heart Loop Measured "l"	Drape	Gurley
Heavy	.75	.20	60
Tag	.26	.39	262
Medium	.14	.32	88
Finishes			
Calendered over Bar	.50	.27	60
Friction Calendered	.43	.29	108
Sprinkled and Calendered	.36	.35	193
Plain Calendered	.26	.31	185
Untreated	.10	.14	3

TABLE VII

Rankings

No. of Material	1	2	3	4	5	6	7	8	9	10	11	12	13
Method of Test													
c	3	8	4	6	9	12	10	11	1	5	2	7	13
G	5	8	4	7	9	12	10	11	1	3	2	6	13
Schiefer Flexometer	6	4	10	8	12	7	11	9	5	3	1	2	13
Drapeometer	8	13	10	11	6	12	5	9	3	7	4	2	1
Gurley Stiffness Tester	4	8	5	6	10	12	9	11	1	3	2	7	13

effect on the stiffness readings of the various instruments we can expect some differences in ranking. The stiffness ranks show significant correlation by the Kendall coefficient of concordance[5].

$S = 3254$ $W' = .71$ $\frac{z}{z} = 1.14$ which is larger than $\frac{z}{z} = .5$ at the 1% level when $f_1 = 10.6$ and $f_2 = 45.4$. Some of the averages are not significantly different from each other so that the exact order of the ranks is not fixed, but the value of $\frac{z}{z}$ does not change enough to be less than 0.5.

When the rankings are compared in pairs, it is seen that only the Drapeometer rank is not significantly like the others. Thus it is evident that factors such as weight and thickness, density and unbalanced forces in the material are more evident in the results of this method than in the results of the other methods. However, if the untreated material is left out, since it has such different density and finish than the other materials, the Drapeometer values are raised to borderline significance with the Heart Loop and Gurley Stiffness Tester. Thus materials of closely related characteristics will not show much difference in stiffness order between the test methods. This fact is more evident in Tables IX-XII.

TABLE VIII

Kendall %T

	c	G	Drape.	Sch.
Gur.	92.3	92.3	18.0	48.7
Sch.	41.0	46.2	—2.6	
Drape.	10.3	15.4		
G	89.7			

38% is significant

$$t = \sqrt{\frac{T\,(\times -2)}{1 - Y^2}}$$

$f = 2$

The correction factor[4] used to change the ranking order given by the Gurley Stiffness Tester to the order given by the Flexural Rigidity, G, is the reciprocal of the weight squared times the square root of the thickness or $\frac{1}{W^2\sqrt{T}}$ in testing ten fabrics of widely different weights and thicknesses. These cotton fabrics are so nearly alike in weight and thickness that no correction factor is needed. ($Y = 38\%$ or over shows a significant correlation between the rankings.)

Gurley Rank = 4 8 5 6 10 12 9 11 1 3 2 7 13 T = 92.3%
G Rank = 5 8 4 7 9 12 10 11 1 3 2 6 13

The correction factor used to change the ranking order given by the Schiefer Flexometer to the order given by the Flexural Rigidity, G, was the thickness divided by the square root of the weight or $\frac{T}{\sqrt{W}}$ in testing ten fabrics of widely different weights and thicknesses. Since the influence of the weight is small and there is so little variation in weight in the cotton fabrics we may write (Schiefer Flexometer value) $\times$ (thickness) $= G'$

G = 1 2 3 4 5 6 7 8 9 10 11 12 13 T = 66.7%
Flexometer Rank (corrected) = 2 3 4 8 5 1 6 11 10 9 7 12 13
and the reverse case
Flexometer Rank = 1 2 3 4 5 6 7 8 9 10 11 12 13 T = 56.3%

G Rank
(corrected) = 2 8 3 4 1 6 10 7 12 5 9 11 13
whereas the uncorrected rankings are
G Rank = 5 8 4 7 9 12 10 11 1 3 2 6 13 $\Upsilon = 46.2\%$
Flexometer
Rank = 6 4 10 8 12 7 11 9 5 3 1 2 13

The correction factor used to change the ranking order given by the Drapeometer to the order given by the Bending Length, c, is $\frac{\sqrt{W}}{T\sqrt{T}}$ (where T is the thickness and W is the weight) in testing ten fabrics of widely different weights and thicknesses. It may be used in this case to correct to the c′ ranking as (D value $\times$ (rank correction factor)^2 = c′ Υ = 48.7%. However, in these tests where there is so little thickness variation in the cotton fabrics the weight influence on the ranking seems stronger so that (D value) $\times$ (weight) $\times$ (rank correction factor)^2 = c shows much better agreement. This revised factor, $\frac{W^2}{T^3}$, shows the best agreement when correcting the Drape rank to c' if the influence of the thickness variation is not taken into account. Thus

(Drape value) $\times$ (weight)^2 = c′

c Rank = 1 2 3 4 5 6 7 8 9 10 11 12 13 $\Upsilon = 69.2\%$
Drape Rank
(corrected) = 1 4 8 5 3 6 2 7 10 9 11 12 13
and
Drape Rank = 1 2 3 4 5 6 7 8 9 10 11 12 13 $\Upsilon = 59.0\%$
c Rank
(corrected) = 2 3 1 9 10 4 11 5 6 7 8 12 13
whereas the uncorrected rankings are
c Rank = 3 8 4 6 9 12 10 11 1 5 2 7 13 $\Upsilon = 5.1\%$
Drape Rank = 8 13 10 11 6 12 5 9 3 7 4 2 1

The methods agree that the Tag treatment is the stiffest and the Medium treatment is the most flexible, except for the Drapeometer which shows the Heavy treatment with its high density as the most flexible. The order of increasing stiffness is the same as the order of increasing thickness and weight. The relatively low thickness of the Heavy treatment causes it to have the highest density and bending modulus, q.

TABLE IX
Average Stiffness of the Treatments

	Tag	*Heavy*	*Medium*
Heart Loop c	5.92	5.70	5.10
G	2862	2323	1532
q	3652	4338	2967
Schiefer Flexometer	131	113	108
Drapeometer	4.14	3.98	4.03
Gurley Stiffness Tester	517	451	327
Thickness cms.	.0218	.0190	.0187
Weight mg./cms.^{2}	13.7	12.5	11.5
Density mg./cms.^{3}	643	670	622

The stiffness order in which each method places the finishes offers an interesting comparison of the factors which influence the measurement of the stiffness. The Hanging Heart Loop bending length (c), and Gurley Stiffness Tester show the Calendered materials as stiffest, then the Sprinkled and Calendered, and the Calendered over Bar and Friction Calendered as the least stiff. The Schiefer Flexometer gives the reverse order. The rigidity (G) shows the Calendered over Bar materials, which are one place thicker, to be one place less stiff, while the Drapeometer shows them one place stiffer. The weight order shows the Calendered materials two places heavier. The density is again in the reverse order compared with the Drapeometer.

TABLE X
Average Stiffness of the Finishes

	Plain Calendered	*Sprinkled and Calendered*	*Calendered Over Bar*	*Friction Calendered*
Heart Loop c	5.88	5.69	5.35	5.34
G	2658	2380	1950	1968
q	2935	3572	2375	5626
Schiefer Flexometer	109.5	117.5	120	122.5
Drapeometer	4.09	4.05	4.09	3.95
Gurley Stiffness Tester	468	453	404	402
Thickness cms.	.0220	.0199	.0212	.0161
Weight mg./cms.^{2}	12.57	12.39	12.56	12.60
Density mg./cms.^{3}	574	627	593	785

The orders may be seen as due to more than variations in the weight of the materials as they affect the methods of testing. When only these materials which are .020 cms. thick are compared, the rigidity (G) and the Gurley Stiffness Tester values are grouped by treatments in the order of decreasing average weight, thus Tag, Heavy, Medium groups, and within these treatments the Sprinkled and Calendered and Plain Calendered materials, rather than the heaviest finishes, are the stiffer. The Drapeometer as before shows the Medium and Tag treatments as the stiffest, and the same two finishes are the stiffest within these groups. While the Schiefer Flexometer also shows the Tag treatment as stiffest, the Calendered over Bar finishes of the other treatments are next in order, with the groupings as given above below them. Thus the change in position of the Calendered over Bar materials measured by the Schiefer Flexometer is not due to the thickness of the materials. While the rigidity (G) and the Gurley Stiffness Tester orders are the same as the weight order of the treatments, the bending length (c), the Schiefer Flexometer, and the Drapeometer orders are more like the orders of the finishes as in Table X.

TABLE XI
Materials of the Same Thickness

Heart Loop c	*Heart Loop* G	*Schiefer Flexometer*	*Drapeometer*	*Gurley Stiffness Tester*
11. 6.01	11. 2926	11. 136.5	11. 4.08	11. 536
3. 5.88	10. 2564	10. 133	7. 4.07	10. 507
1. 5.88	3. 2541	4. 112	5. 4.06	1. 477
10. 5.73	1. 2521	8. 112	10. 4.04	3. 472
4. 5.60	4. 2199	1. 111.5	8. 4.03	4. 449
5. 5.30	5. 1709	3. 109	1. 4.03	7. 352
7. 5.26	7. 1672	7. 107	3. 4.02	5. 341
8. 5.00	8. 1434	5. 98	4. 4.00	8. 322

10 and 7 are a little less than .020 cm.

TABLE XII

	Heart Loop c	*Heart Loop* G	*Drapeometer*	*Gurley Stiffness Tester*	*Schiefer Flexometer*	*Bending Modulus* q	*Density* mg/cm³
Medium Treatment	5. 5.30	1709	7. 4.07	7. 352	6. 115	6. 4482	8. 565
	7. 5.26	1672	5. 4.06	5. 341	8. 112	7. 2879	5. 566
	8. 5.00	1434	8. 4.03	8. 322	7. 107	5. 2450	7. 602
	6. 4.85	1311	6. 3.94	6. 294	5. 98	8. 2056	6. 756
Heavy Treatment	3. 5.88	2541	1. 4.03	1. 477	2. 119.5	2. 6940	1. 611
	1. 5.88	2521	3. 4.02	3. 472	4. 112	3. 3643	3. 616
	4. 5.60	2199	4. 4.00	4. 449	1. 111.5	1. 3614	4. 617
	2. 5.43	2030	2. 3.88	2. 404	3. 109	4. 3153	2. 834
Tag Treatment	9. 6.47	3743	12. 4.24	9. 586	11. 136.5	10. 5455	9. 544
	11. 6.01	2926	9. 4.18	11. 536	12. 136	11. 4195	12. 598
	10. 5.73	2564	11. 4.08	10. 507	10. 133	9. 2740	11. 664
	12. 5.45	2216	10. 4.04	12. 440	9. 119	12. 2216	10. 766

When the materials are grouped by treatment and then arranged in the order of stiffness, the orders show the relative stiffness of the finishes when all but small differences in weight are eliminated as well as the difference in treatments. Under these conditions the Hanging Heart Loop, the Drapeometer, and the Gurley Stiffness Tester are in the same order while the Schiefer Flexometer and the bending modulus (q) are about in the reverse order. The Drapeometer order is now the same as increasing thickness, or decreasing density, as are the Hanging Heart Loop and Gurley Stiffness Tester orders except for Material 12 which has had additional softening treatment and shows the most flexible in these two orders. The Schiefer Flexometer and the bending modulus (q) orders are about in the order of increasing density or decreasing thickness.

When the Hanging Heart Loop and Gurley Stiffness Tester orders in the treatments and in the finishes are considered it is seen that they vary as the thickness and weight in the treatments but less regularly in the finishes where the differences in thickness and weight seem to be too small to affect the two stiffness orders to any extent. The behavior of the rigidity (G) and the Gurley Stiffness Tester values are also shown similar in this respect by the correction factors where if the stiffness values of these rankings were to be corrected to a c′ order they must be divided by an expression involving the weight. The bending modulus (q) order is seen to vary inversely as the thickness and directly as the density in both the treatments and the finishes as would be expected from its derivation.

The Schiefer Flexometer order is like that of the rigidity (G) with the large weight variations which are present in the treatments, but it is the reciprocal of that order (and more like the bending modulus (q) order) in the finishes where there are only small weight differences. This change would indicate that the order varies directly with the weight but inversely with the thickness. The correction factor also shows such a relationship, since Schiefer stiffness values must be multiplied by a function of the thickness and divided by a function of the weight to be corrected to a c′ order. Further consideration of the Schiefer Flexometer and the bending modulus (q) orders shows that in the finishes those materials which are thinner are relatively more flexible in the second order. Thus the stiffness values in this order are more influenced by a difference in thickness than are those of the Schiefer Flexometer. The correction factor indicates that such is the case since the first order is multiplied by a higher power of the thickness value than is the second. This fact also explains why weight differences would have more affect on the Schiefer Flexometer stiffness values.

The Drapeometer order varies inversely with the density and more as the thickness and decreasing weight in both the finishes and the treatments. Similarly the values in a Drapeometer ranking must be multiplied by a function of the weight, and in some cases divided by a function of the thickness, to be corrected to a c′ ranking.

When the factor of thickness is omitted or eliminated, the Heart Loop order resembles those of the bending modulus (q), the Schiefer Flexometer and the Gurley Stiffness Tester because their stiffness values then tend to vary directly as the weight, while the Drapeometer values tend to vary as the reciprocal of the weight. When the factor of weight is eliminated the Heart Loop order resembles those of the Gurley Stiffness Tester and Drapeometer while the Schiefer Flexometer and bending modulus (q) orders tend to vary inversely to the thickness. In the original orders those of the Heart Loop, Schiefer Flexometer, and Gurley Stiffness Tester are significantly the same because the weight differences affect them in the same manner.

The Drapeometer measures the "draping" quality of the material. Although the ranking thus determined may differ from that by other tests, the Drapeometer is nevertheless a sensitive measure for comparing finishing treatments. In the last analysis the quality used as a comparative measure is not so important. What is of importance is the ability of the method to distinguish precisely and sensitively between small differences in finish. Any data by whatever method must eventually be correlated with service. The Drapeometer data can undoubtedly be so correlated. This is believed to be the case particularly since a study of the contour diagrams, which show the variation of the shape of the hanging specimen at successive

points in its length, indicates that by their symmetry (or conversely their assymetry) something of the condition of the residual forces present as a consequence of weaving or finishing operations may be learned. As has been noted such analyses are to be discussed in detail in a later paper of this series.

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[1]Schwarz, E. R. and Winn, L. J. "Technical Evaluation of Textile Finishing Treatments," Parts II and III. Part II: *Tex. Res.*, November 1939, Vol. X, No. 1, pp. 5-16; *American Dyestuff Reporter*, Vol. 28, No. 24, November 1939, pp. 688-694.

[2]Pierce, F. T. "The Handle of Cloth as a Measurable Quality." *Journal of the Textile Institute*, Vol. XXI, 1930, pp. T377-416.

[3]Schiefer, H. F. "The Flexometer, An Instrument for Evaluating the Flexural Properties of Cloth and Similar Materials." *Tex. Res.*, Vol. III, 1933, pp. 388-408; *Bureau of Standards Journal of Research*, Vol. 10, 1933, Paper No. 555.

[4]Schwarz, E. R. and Winn, L. J. "Technical Evaluation of Textile Finishing Treatments," Part IV. *American Dyestuff Reporter*, Sept. 16, 1940, Vol. 29, No. 19, pp. 469-476.

[5]Ibid. Part III. *Textile Research*, Sept. 1940, Vol. X, No. 11, pp. 453-469; *American Dyestuff Reporter*, Aug. 5, 1940, Vol. 29, No. 16, pp. 400-404.

MEETING, PIEDMONT SECTION

THE Piedmont Section held its Fall meeting on November 2, at the Carolina Hotel at Pinehurst, N. C. A technical session was held in the afternoon with the following program: A Technicolor picture, "More Than Meets the Eye," by the Interchemical Corp., also a talk, "The Evaluation of Water Resisting Textile Finishes," by George A. Slowinske of E. I. du Pont de Nemours & Co.

After the banquet in the evening a speech was given by Dr. W. S. Landis, Vice-President of the American Cyanamid Co.

Officers for next year who were duly elected were announced as follows: L. M. Boyd, Salisbury, N. C., Chairman; T. W. Church, Charlotte, N. C., Vice-Chairman; D. Stewart Quern, Charlotte, N. C., Secretary; R. D. Howerton, Charlotte, N. C., Treasurer; A. H. Gaede, Charlotte, N. C., Councilor; H. E. Kiefer, Jr., Ware Shoals, S. C., Councilor.

Sectional Committeemen: E. S. Tillinghast, Greenville, S. C.; Peter S. Gilchrist, Charlotte, N. C.; L. G. Atkins, Charlotte, N. C.; R. H. Tuttle, Leakesville, N. C.

Respectfully submitted,

R. D. SLOAN, *Secretary*.

ONE HUNDRED AND TWENTY-SECOND MEETING OF THE RESEARCH COMMITTEE

THE 122nd meeting of the Research Committee followed the Council meeting in New York on Friday, October 18, 1940. Present were Chairman Louis A. Olney presiding, W. D. Appel, K. H. Barnard, J. R. Bonnar, W. H. Cady, H. Christison, H. D. Clayton, P. N. Collier, R. F. Culver, J. N. Dalton, F. Dannerth, R. E. Derby, C. Z. Draves, A. Eavenson, E. Freedman, A. H. Gaede, A. C. Goodings, A. H. Grimshaw, W. E. Hadley, V. T. Hartquist, A. E. Hirst, E. H. Killheffer, D. P. Knowland, L. S. Lang, A. R. Macormac, A. M. Maurer, W. R. Moorhouse, G. A. Moran, C. L. Nutting, R. W. Philip, F. A. Prisley, R. E. Rose, R. E. Rupp, B. A. Ryberg, C. H. A. Schmitt, W. M. Scott, C. A. Seibert, R. H. Souther, W. A. Stringfellow, A. R. Thompson, Jr., H. S. Travis, B. Verity, W. A. Wolhar, P. J. Wood, and H. C. Chapin, Secretary.

The Chairman announced the completed membership of the new Committee on Standardization and Interpretation, as listed in the 1940 Year Book. Mr. Ryberg reviewed the various standard methods published in the Year Book. The question was raised whether the Federal Wool Labeling Act should be considered by a new committee, but on motion of Mr. Dalton it was referred to the Committee on Technology of Wool. It was announced that a Committee on Fastness to Dry Cleansing was to be organized by Mr. Seibert. There was debate between Mr. Christison, Mr. Seibert and Mr. Dalton, as to whether color change in dry cleaning, especially of chrome browns, was due to the cleaning agent or to perspiration. Mr. Freedman suggested aluminum chloride in deodorants as a possible source of trouble.

Mr. Appel reported on light fading experiments made at the National Bureau of Standards during the summer, and discussed efforts being made by manufacturers to improve arc fading machines. In the summer experiments, the commercial tungsten filament, mercury vapor lamps, found by the Bureau suitable for fading tests on plastics, had proved too slow for textile fading. Mr. Appel reported further progress toward agreement with the British Society of Dyers and Colourists on light fastness standards.

Mr. Cady reported for the Committee on Gas Fading, stating the committee proposed to issue specifications for suitable testing apparatus, and to provide dyed standards for test control. The standards he said would have to be replaced at frequent intervals, as they became faded in storage. Mr. Clayton, reporting for the Committee on Shrinkage of Textiles, recommended that the test proposed by the committee be adopted provisionally for wool, silk and stabilized rayon. Work was under way, he said, on a more satisfactory device for smoothing out the sample before final measurement. Mr. Seibert raised the question whether the alkali content of hypochlorite in wash fastness tests should not be more definitely specified. Mr. Hirst stated that he had already corresponded with members of the Committee on Fastness of Cotton to Washing, and that with Mr. Moran, he was endeavoring to crystallize opinion on this subject.

The Chairman reported that three dyestuff companies already have adopted the standard A.A.T.C.C. methods in their dye specifications. He requested that dyestuff companies file specimens of all their current dye sample cards with the Research Committee.

Respectfully submitted,

HAROLD C. CHAPIN, *Secretary*.

Microscopic Observations of Wool Dyeing*

Part II

G. L. ROYER and H. E. MILLSON**

IN a previous paper on this subject[1], some of the results which had been observed in our microscopical examination of wool dyeing were shown. In this paper, we should like to review very briefly some of these observations, discuss newer ones, and relate them to the fastness properties of the final dyed goods. Much has been written on the dyeing of wool but our present interest in this subject is chiefly in the mechanism of dyeing as it affects the shade and fastness of the final dyed material. We believe that the phenomena which can be seen through the microscope show us much of the mechanism of dyeing as it affects the properties of the dyed goods.

As was the case with the presentation of Part I, this present paper was illustrated at the annual meeting of the A.A.T.C.C. in New York with about seventy-five colored slides taken by the Kodachrome Process. The black and white photographs shown in this paper were reproduced from a few of these slides.

In the commercial field of dyeing, the dyer is concerned chiefly with the rate of dyeing, since equilibrium conditions are not always obtained. Microscopical studies reveal any lack of uniformity and make it a means for studying methods to overcome such conditions. In dyeing pieces, the dye must first be transferred through the fabric, then through the threads, and finally through the individual fibers before uniform conditions exist. The transfer of the dye from fiber to fiber and within the individual fiber itself is an important factor in the dyeing process and the fastness properties of the resulting dyeing. The microscopical observations show the location of the dye and how different exhausting agents affect its transfer both during the dyeing process and also during any subsequent treatment which the dye fabric must undergo.

In our previous paper, it was shown that some dyestuffs, such as Calcocid Orange Y Ex. Conc., dye all fibers equally, while other dyes, such as Calcocid Amaranth Extra and most milling colors, show very uneven fiber dyeing when the fibers are examined in cross section. One cause of uneven fiber dyeing which our previous experiments proved, was that individual wool fibers do not all dye at the same rate, even when they have been thoroughly scoured and are dyed in a dye bath with good circulation of dye solution about the fibers. One reason for this difference in rate was shown to be variations in the surface structure of the fibers. Both motion pictures and still photomicrographs revealed fibers which dyed readily and ones which dyed only with difficulty. In the case of all fibers, the center portion, which was exposed to the dye bath at the cut ends, dyed with ease. This pointed definitely to the fact that the external layer of the wool fiber influenced the rate at which the dye can penetrate. When the scales or surface structure of a fiber had been altered by mechanical damage it allowed the dye to penetrate through the surface and dye the internal part of the fiber. Harris and his associates at the National Bureau of Standards confirm this observation in their studies of enzyme reactions on wool. Harris states[2]: "It appears that the surface of the undamaged fiber is practically impermeable to the enzyme and must be broken either mechanically or chemically before the enzyme can penetrate and digest even portions of the fiber."

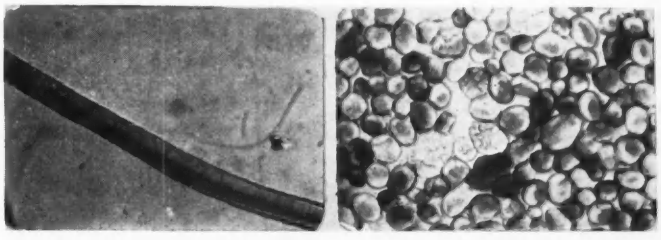
LEVELING STUDIES

Individual Fibers

In the close examination of individual fibers, it is seen that many dyes do not distribute themselves evenly through the single fiber. We believe this is due to differences in the fiber structure which may have been caused by weather and sunlight damage to the fibers as they are held in position while still on the animal's back. Fig. 1a shows such a fiber dyed with Calcocid Violet 4BXN and the dye

Fig. 1

a b



*Presented at Symposium on Chemical and Dyeing Aids for the Textile Industry, Annual Meeting, New York, N. Y., October. 19, 1940.

**Calco Chemical Division, American Cyanamid Company, Bound Brook, N. J.

[1]Am. Dyestuff Reporter *28*, 632 (1939).

[2]Private communication to G. L. Royer.

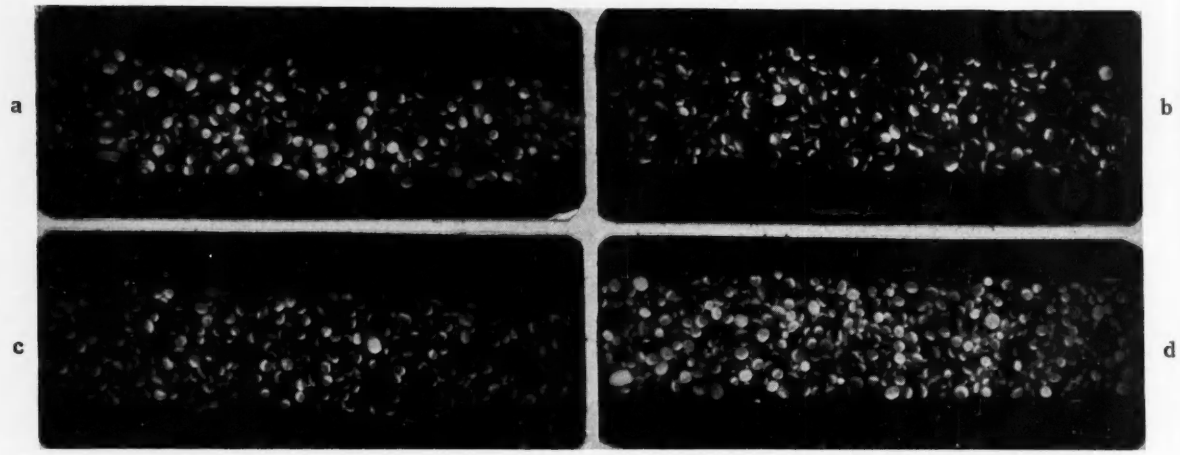


Fig. 2

appears only as a streak along the fiber. In cross section, the fibers show segregation of dye as can be seen in Fig. 1b. This means that the diffusion of dye into an individual fiber is not uniform through all parts of its surface. Therefore, in addition to uneven fiber dyeing which we have shown exists from fiber to fiber, there can be uneven distribution within the individual fiber.

Fluorescent Method for Studying Fiber Levelness

The cross-sectional method for studying level fiber dyeing makes it possible to see how the individual fibers are dyed. It is easy to see whether a dyeing is good or bad in this respect by a rough examination under the microscope. However, when the differences in level dyeing characteristics are not very great, it becomes more difficult to judge the level fiber dyeing by a rough microscopical examination. To differentiate between small differences in level fiber dyeing, a fluorescent microscopical method was devised. The wool on which the dye was to be tested for level fiber dyeing was first dyed with a predetermined level fiber dyeing, fluorescent dyestuff. Such a dyestuff showed by cross-sectional examination a brilliant fluorescence of about the same intensity throughout all the fibers. When the wool was subsequently redyed with a non-fluorescent dyestuff, the fluorescence was covered up wherever the second dye penetrated. Fluorescence was obtained only from those portions not dyed. This method makes it possible to reveal the leveling characteristics of certain dyes. Fig. 2 shows four cross sections of dyeings of Calcocid Violet 4 BXN redyed over a fluorescent flavine using several dyeing procedures. Fig. 2a was dyed with 20 per cent ammonium acetate, Fig. 2b with 10 per cent ammonium sulfate, Fig. 2c with 20 per cent Glauber's, and Fig. 2d with 4 per cent Vitriol and 8 per cent Glauber's. It appears that Fig. 2a and 2b give the best leveling while Fig. 2d is the poorest.

A similar procedure to the above could be used with contrasting colors in ordinary light, but the ultra-violet light gives a much more marked contrast since it accentuates small amounts of the fluorescent dye. It is, of course, obvious that a method of this type is not necessary when the differences in leveling are quite marked.

Effect of Temperature on Level Fiber Dyeing

In our previous article we discussed the dyeing of Calcocid Orange Y Ex. Conc. carried out at room temperature by a cold procedure as contrasted with a procedure at the boil. It was thought that possibly equilibrium conditions had not been obtained at the lower temperature and that a longer dyeing period might give much better penetration. Therefore, a new series of experiments was carried out in which 2 per cent dyeings were dyed at room temperature and at the boil until equilibrium exhaustion was obtained. The exhaustion was followed by continuous colorimetric measurements of the dye bath. Equilibrium exhaustion was reached when measurements showed no more dye was being exhausted from the dye bath. The approximate dye color value and shade of the skeins were determined as desired by spectrophotometric reflectance measurements.

Fig. 3

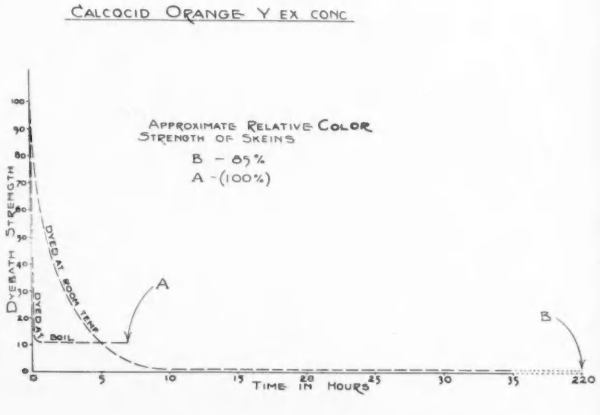


Fig. 3 shows the dye exhaustion curves obtained when Calcocid Orange Y Ex. Conc. was dyed at 2 per cent with 8 per cent Glauber's salt and 4 per cent sulfuric acid at both room temperature (77° F.) and at the boil. It can be seen that at the boil, equilibrium exhaustion was reached in less than ½ hour's time. In the case of the dyeings carried out at 77° F., equilibrium exhaustion was not obtained until after 11 hours. It was interesting to note that the exhaustion obtained at room temperature was greater than that obtained at the boil. About 1 per cent was left in the bath in the case of a dyeing at room temperature, while about 11 per cent remained in the dye bath at 212° F. The data at equilibrium exhaustion implied that there was more dye exhausted on the skein at room temperature than at the boil. Nevertheless, a visual comparison of the skeins showed the skein dyed at the boil to be the stronger. Cross-sectional examination of the dyeings removed at equilibrium exhaustion showed much better dye distribution in the sample dyed at the boil. When the room temperature dyed skein was boiled in a dye-free, acid, Glauber's salt bath, the dye was shown to be redistributed and an increase in color strength was obtained. These experiments indicate that the shade and color strength of a dyeing depend upon the distribution of the dye within the fibers and that maximum exhaustion does not necessarily give the maximum color value.

In the case of Calcocid Alizarine Green CG Extra, Fig.

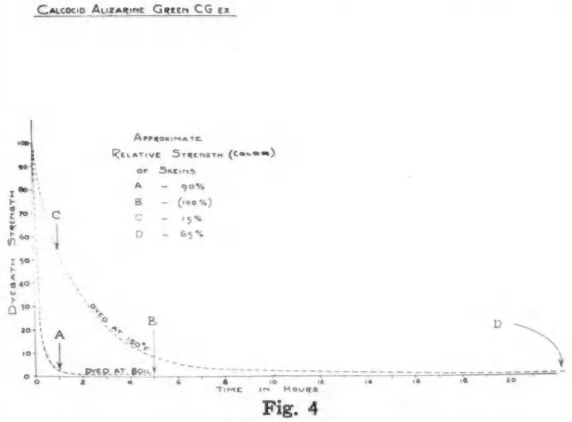


Fig. 4

4, the results are somewhat different. Equilibrium exhaustion at the boil was obtained in about 2 hours' time, but at room temperature it was not obtained until after 22 hours. With this dyestuff equilibrium exhaustion was independent of the temperature and occurred when about 1 per cent of the dye was left in the bath. In both experiments, samples were removed after one hour and when equilibrium exhaustion was obtained. The approximate dye concentration on these skeins is given in Fig. 4. The results show that even though complete equilibrium exhaustion was obtained after 1 hour at the boil, maximum color value was not obtained on the skein, nor was maximum color value developed in the case of the room temperature dyeings carried out for one hour to equilibrium. However, when these dyeings were placed in an acetic acid dye-free bath and boiled, an increase in color value was obtained. By a similar treatment an increase in color value was also obtained with the sample dyed at the boil, but removed after a 1-hour period. Cross-sectional examination of these dyeings showed differences in dye distribution which it was believed was the cause for the increased color development. Poor distribution of color was obtained in the dyeing made at room temperature while the distribution was very good after this same skein was boiled in a solution containing only acetic acid and Glauber's salt.

When Calcocid Rhodamine B Extra was studied, Fig.

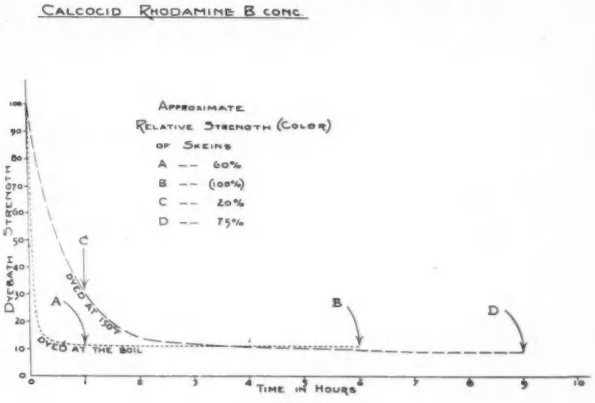


Fig. 5

5, it was found that equilibrium exhaustion was obtained after 1 hour at the boil, while it required over 7 hours to obtain equilibrium at room temperature. At equilibrium exhaustion, the amount of dye remaining in the dye baths was only about 2 per cent greater for the dyeing carried out at the boil than for the dyeing carried out at room temperature. The amount of exhaustion was about the same in both cases and any difference in dye color value on the skein must have been due to the effect of a difference in dye distribution. Color measurements, given in Fig. 5, showed that the skein dyed at the boil had greater color value. Cross-sectional examination revealed that the dyeing carried out at room temperature to equilibrium exhaustion did not have good fiber levelness, while that which was carried out to equilibrium exhaustion at the boil appeared good in fiber levelness. A portion of the skein which showed poor fiber levelness, on being boiled in a dye-free sulfuric acid bath, developed a marked increase in color value.

In studying the dyeing of Calcocid Phloxine 2G, dyeings were carried out at 212° F., 150° F., and at 77° F. Fig. 6 shows the exhaustion rate curves for these dyeings, and the spectrophotometric strength measurements of the dyed skeins. It can be seen that the dyeing carried out at 212° F. came to an exhaustion equilibrium after about 15 minutes, the dyeing carried out at 150° F.

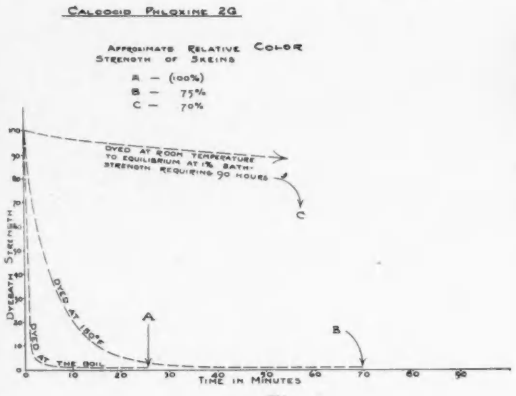


Fig. 6

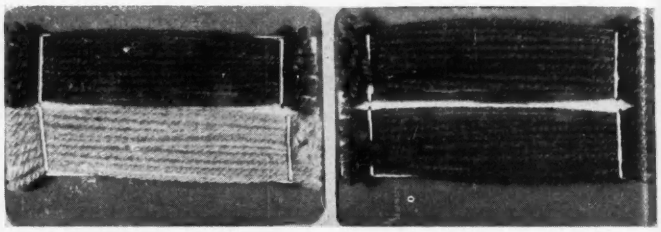
came to an equilibrium in about 45 minutes, while the dyeing carried out at room temperature did not come to equilibrium until after 90 hours. The spectrophotometric strength measurements are shown in Fig. 6. Cross-sectional examination showed that the boiled dyeing had good fiber levelness, while the skeins dyed at 150° F. and at room temperature were poor in this respect. However, when the 150° dyeing and the room temperature dyeing were boiled in a dye-free sulfuric acid, Glauber's salt bath, a marked increase in strength took place. These experiments, with Calcocid Phloxine 2G, proved that even though the equilibrium exhaustion was the same amount at all three temperatures, the color value developed on the skein was not the same. However, if the dyed skein was boiled in a dye-free bath to redistribute the location of the dye, increased color value was obtained.

The conclusion which can be drawn from these experiments is that the location and distribution of the dye within the single fibers influence the shade and strength which are obtained, and although the same amount of dye is exhausted from the bath, it does not follow that the same shade and strength are necessarily obtained. Fig. 7 shows a table which summarizes the results obtained from the dyeing rate curves and the spectrophotometric measurements.

Fig. 7

LOW TEMPERATURE DYEING COMPARED WITH DYEING AT THE BOIL

Color	Percent Exhaust of the Dye Bath		Time Required to Reach Equilibrium		Relative Color-Value of Dyed Skeins	
	At the Boil	At Low Temperature	At the Boil	At Low Temperature	At the Boil	At Low Temperature
Calcocid Orange V ex conc	89%	99% (room temp)	½ hour	11 hrs (room temp)	(100%)	85% (room temp)
Calcocid Alizarine Green CG ex	99%	99% (150°F)	2 hours	22 hrs (150°F)	(100%)	69% (150°F)
Calcocid Rhodamine B conc	89%	91% (150°F)	1 hour	7 hrs (150°F)	(100%)	75% (150°F)
Calcocid Phloxine 2G	99%	99% (room temp) 99% (150°F)	15 minutes	90 hrs (room temp) 45 min (150°F)	(100%)	70% (room temp) 75% (150°F)



a Fig. 8 b

DETRIMENTAL EFFECTS OF ACID ON THE LEVELING OF SOME CHROME COLORS

It is known that very few chrome dyes can be dyed with sulfuric acid, but must be dyed with weaker acids if good penetration and color value are to be obtained. It was thought that the sulfuric acid destroyed the color, whereas this was not the case with the weaker acids. An example of this phenomenon is the dyeing of a chrome brown. Fig. 8a shows two dyeings, each dyed with 2 per cent of a chrome brown, the upper one with acetic acid and the lower one with sulfuric acid. It is obvious that the one dyed with sulfuric acid is very weak in comparison with the other. When these two dyeings were examined microscopically, it was found that in the case of the sulfuric acid dyeing the dyestuff had been precipitated in rather large crystals over the wool fibers. Cross sections of the two dyeings are shown in Fig. 9a and c and the dyestuff can be seen on the outer surfaces of the fibers in Fig. 9a. Fig 10 shows longitudinal microscopical views of these same dyeings, and here again precipitated color is visible on the lighter fibers in Fig. 10a, while the darker fibers appear to be very well dyed in Fig. 10b. Both of the above skeins were put into a bath of ammonia and boiled so as to dissolve the color. Then acid was added slowly and the dye exhausted to give good penetration into the fibers. Fig. 8b shows these dyeings after this treatment and Figs. 9b and d the cross sections. From Fig. 11, it can be seen that increased color strength has been obtained especially in the case of the dyeing which appeared very weak at the beginning. While this is an outstanding case of uneven dye distribution to the extent of precipitation on the outside of the fiber, there are other dyes which show this phenomenon to different degrees, depending upon the dyeing conditions. The investigation of this subject is being continued.

DYE DISTRIBUTION AS IT AFFECTS THE PROPERTIES OF DYED GOODS

Our experiments have indicated that the dyeing methods used for exhaustion of the dye bath determined to a considerable extent the color strength of the resultant shade. Complete equilibrium exhaustion of the dye from a bath does not necessarily guarantee a maximum development of color value. The rate of exhaustion, temperature, acidity, and the condition of the fibers during the dyeing operation, each plays an important part in the fiber level-

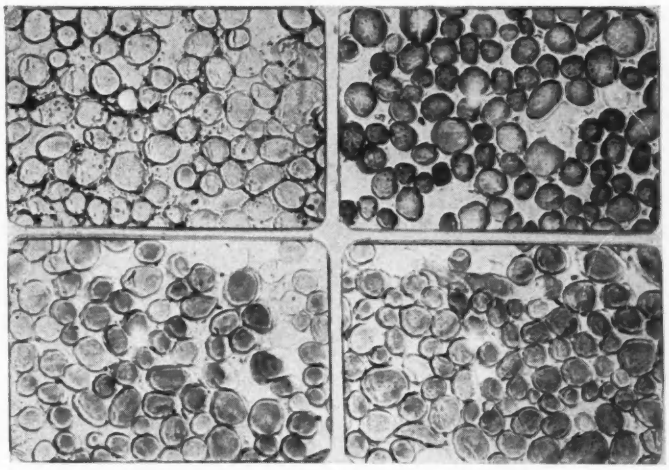


Fig. 9

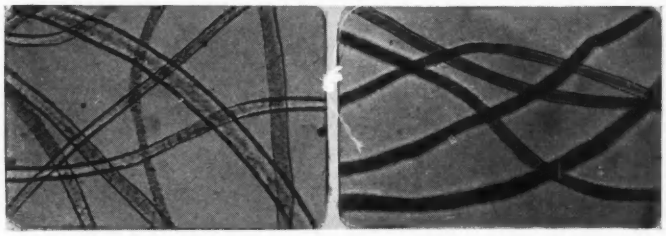


Fig. 10

ness and shade of a finished lot. It is known that standard dyehouse formulae do not always give the same shade for repeat lots even though the same stock and machine are used. When a standard formula comes up too heavy or too light, it is not necessarily caused by inaccuracy in weighing, as it can easily be due to the fact that all conditions of the previous lot were not reproduced.

Fig. 11

CHROME BROWN

SKEIN	DYEING METHOD	APPROXIMATE RELATIVE STRENGTH (COLOR)
A	DYED WITH SULFURIC ACID.—	10%
B	DYED WITH ACETIC ACID—	70%
A-1	SKEIN "A" TREATED WITH AMMONIA AND REDYED WITH ACETIC ACID IN DYE-FREE BATH	60%
B-1	SKEIN "B" TREATED WITH AMMONIA AND RE-DYED WITH ACETIC ACID IN DYE-FREE BATH	(100%)

It has been found that a number of dyes exhausted for about 1 hour at 150° F. have poor distribution of the dye throughout the fibers. If these dyeings were removed from the original dye bath, rinsed, and then boiled in a bath containing no dye but only distilled water, Glauber's salt and acid, a better distribution of the dye would take place with a corresponding increase in color value. (See Fig. 12.) Many of these dyeings made at the low temperature of 150° F. cannot be duplicated for shade or strength by attempting to match them with different percentages of the same color dyed at the boil. However, after the 150° F. dyeing has been re-treated by boiling, a match can be produced with dyeings made by the usual boiling procedure. Microscopical examination of the cross sections of these dyeings revealed that a redistribution of the dye took place within the fiber on boiling. Fig. 13 shows microscopical cross sections of four dyeings dyed at 150° F. and the same dyeings after boiling the skein in a dye-free acid and Glauber's salt bath for ½ hour. The 150° dyeings were made as follows:

Calcocid Phloxine 2G—10 per cent Glauber's and 4 per cent sulfuric acid.

Calcocid Rhodamine B Conc.—10 per cent Glauber's and 4 per cent sulfuric acid.

Calcocid Aliz. Blue SAPG—10 per cent Glauber's and 4 per cent sulfuric acid.

Calcocid Aliz. Green CG Ex.—10 per cent Glauber's and 6 per cent acetic acid.

In all cases, the 1 hour, 150° F. dyeings showed some fibers with a concentration of the dye on the surface to form rings, other fibers which were heavily dyed, and still some other fibers which were undyed. The cross sec-

Fig. 12

STRENGTH INCREASE OBTAINED WHEN A LOW TEMPERATURE DYEING IS BOILED

COLOR	RELATIVE COLOR VALUE OF DYED SKEIN	
	DYED AT LOW TEMPERATURE	SAME SKEIN BOILED ½ HOUR IN DYE-FREE BATH
CALCOCID ALIZARINE GREEN CG EX	50% (150°F)	(100%)
CALCOCID PHLOXINE 2G	45% (150°F)	(100%)
CALCOCID ALIZARINE BLUE SAPG	35% (150°F)	(100%)
CALCOCID RHODAMINE B	50% (150°F)	(100%)

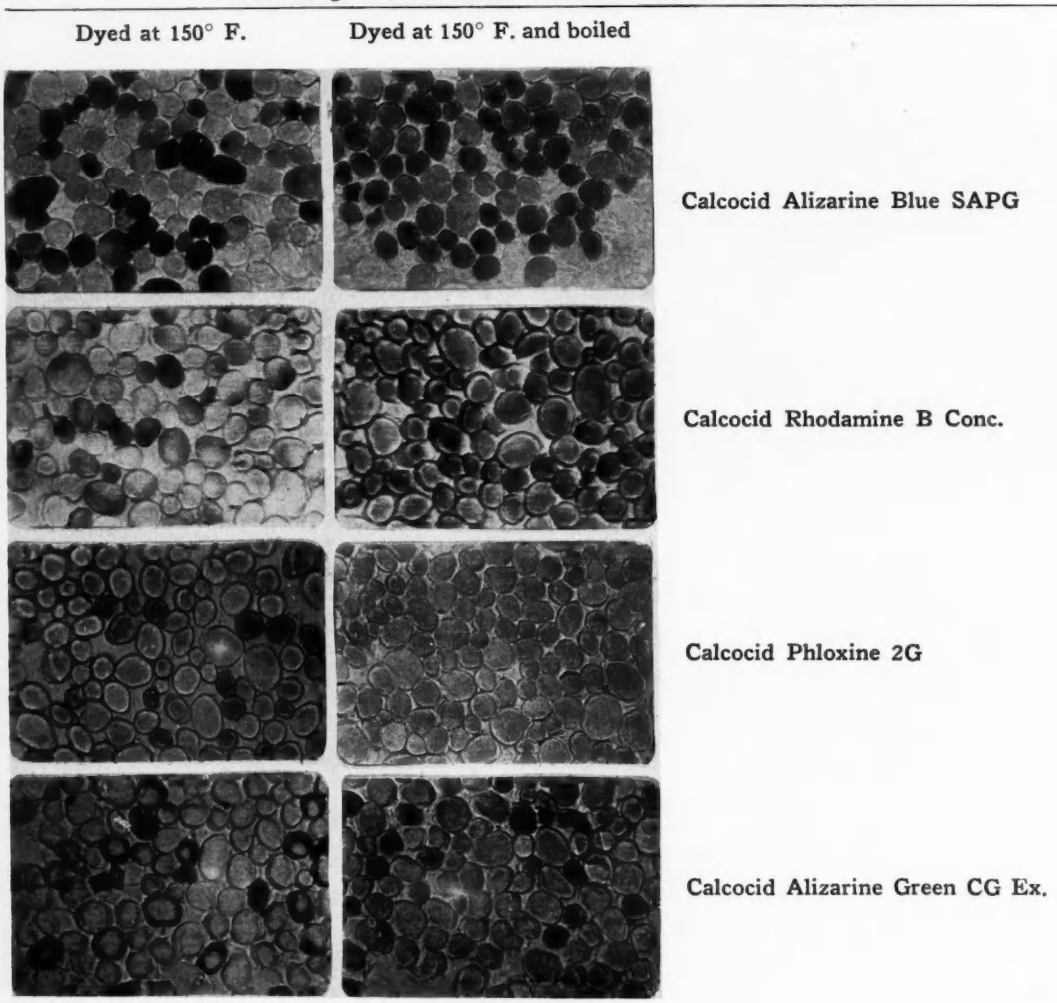

Dyed at 150° F.
Dyed at 150° F. and boiled
Calcocid Alizarine Blue SAPG
Calcocid Rhodamine B Conc.
Calcocid Phloxine 2G
Calcocid Alizarine Green CG Ex.

Fig. 13

tions of the boiled dyeings showed a more uniform fiber pattern in that all of the fibers were much more uniformly penetrated. To obtain a solid shade and maximum strength, complete exhaustion of the dyebath may not always be as important as the proper distribution of the dye within the wool fibers.

DYE DISTRIBUTION AS IT AFFECTS WASH FASTNESS

Wash tests showed that a sample dyed at 150° F., which exhibited very poor dye distribution, was not as fast to washing as the same sample after boiling in a dye-free acid bath. This observation led to a microscopical cross-sectional study of the washing process. The original skein was cross-sectioned and then sections were made of the same skein after it had remained in the wash test solution (A.A.T.C.C. Wash Test No. 3) for periods of ½, 4, and 8 hours. Fig. 14 shows a series of cross sections for Calcocid Milling Red 3R Conc., dyed at 2 per cent concentration. From these cross sections, it appeared that the washing process was the reverse of the dyeing process. The dye was removed first from the outside of the fiber and produced colorless rings around many of the fibers. Some of the fibers were depleted of dye before others. This is in contrast to the dyeing process in which some fibers are dyed more heavily than others. Therefore, in the washing operation, the dye is first removed from those fibers where it is on the surface and from those fibers which readily give up the dye because of their fiber structure. A dyeing which possesses good fiber levelness will, therefore, be faster to washing since good distribution of the dye within the fibers makes the dye less accessible to the washing bath.

In the preparation of many wool fabrics, undyed wool is frequently blended with dyed wool to give certain effects. In such mixtures, it is assumed that any undyed or poorly dyed fibers in the dyed portion will not produce a detrimental effect upon the fastness properties.

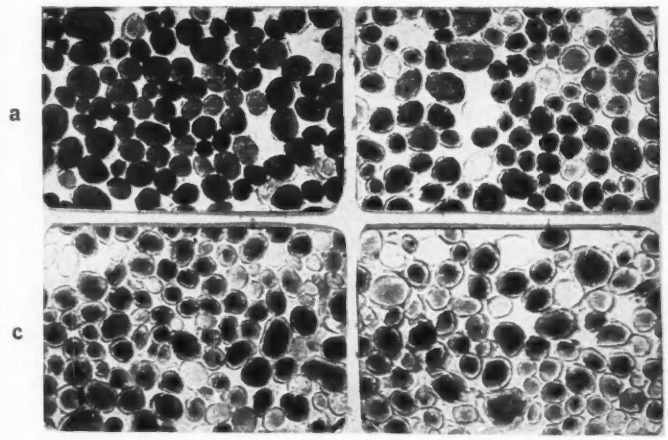


Fig. 14

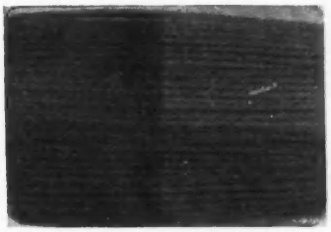


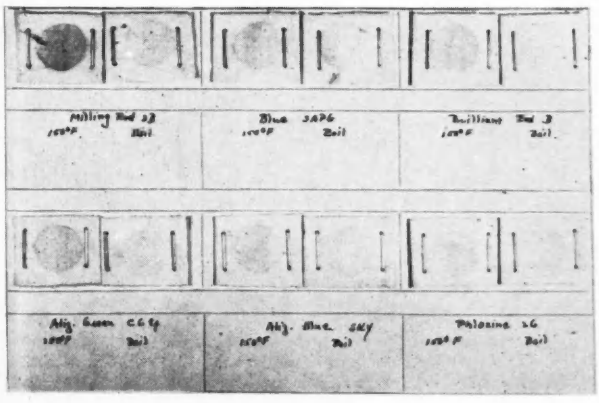
Fig. 16

However, the washing fastness may be affected because the dye in the dyed fibers in the mixture is not distributed in the fibers to give the best fastness. While it may not be necessary to have good distribution of color within the fibers from the viewpoint of the appearance of the final goods, nevertheless, in order to obtain the maximum fastness, it is an advantage to have the dye distributed within each colored fiber as well as possible.

DYE DISTRIBUTION AS IT AFFECTS CROCKING FASTNESS

If good dye distribution within the fibers is not obtained, the crocking fastness is apt to be poor. Since most of the dye is concentrated on the surface of the individual fibers and not penetrated uniformly throughout, it would easily rub off. Fig. 15 shows a series of crocking tests made on the same dyeings described in connection with Fig. 13. In all cases, the dyeings which were made at 150° F. show less fastness to crocking than the same dyeings after they had been boiled in a dye-free acid bath. The boiling period redistributed the dyestuff throughout the fibers and located the dye in a position where it cannot easily be rubbed off.

Fig. 15



DYE DISTRIBUTION AS IT AFFECTS LIGHT FASTNESS

The light fastness of a dyeing has also been found to be dependent to some extent upon dye distribution. If the dyestuff has penetrated into all of the fibers rather than remained on the surface, it would seem that the dye would be more protected from the light. While the phenomenon of light fastness depends to a considerable extent upon the dyestuff itself, it is often found that dyestuffs will give different degrees of light fastness when applied to different materials. This would indicate that there are other important factors in connection with light fastness in addition to the constitution of the dyestuffs.

Our results showed that the dyeings carried out at 150° F., which lack uniformity of dye distribution, do not have as good a light fastness rating as the same dyeings after they have been boiled in a dye-free acid bath which redistributed the dyestuff. (See Fig. 16). Other experiments that have been made indicated that light does not penetrate very far into the individual fibers and that most of the action took place at or near the surface. Because of certain difficulties relative to the technique of carrying out fading investigations and making observations, we have done little microscopical cross-sectional work in studying light fading, where the fiber is exposed on the side. However, we have made cross sections of dyeings and exposed these cross sections through the cut end in the Fade-Ometer. A series of such exposures is shown in Fig. 17. It can be seen that when the fibers were exposed in this manner, the fading seemed to take place uniformly over the entire cross section. The fibers which were dyed heavily at the start were those which contain the most dye after the fading has taken place. Poorly dyed fibers, on the other hand, fade out first.

CONCLUSIONS

Many of the properties of dyed wool goods and woolen materials appear to be closely related to the uneven distribution of dyes in the individual fibers; some of the fac-

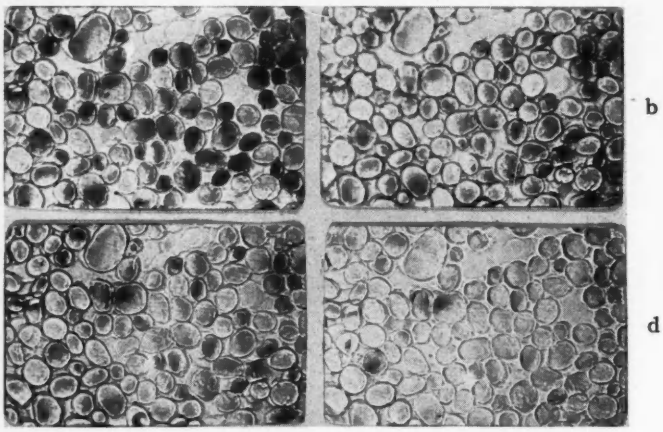


Fig. 17

tors causing uneven fiber dyeing were discussed in our previous paper. The present experiments have indicated that poor fiber levelness will result in weaker color strengths and different shades than those obtained when uniform dye distribution exists throughout the fibers with the same amount of dye. It has furthermore been revealed that such properties as wash fastness, crocking, and light fastness are affected by dye distribution. Cross-sectional microscopical examination of dyeings are of value in studying these phenomena.

We are indebted to Dr. R. H. Kienle, Mr. C. H. Benbrook, and Mr. W. H. Watkins for dyeings and the dyeing rate data; and to Mrs. Anna N. Harding for the preparation of the cross-sections shown in this paper.

Tentative Method:

Fastness to Atmospheric Gases of Dyes on Cellulose Acetate Rayon

AT a recent meeting of the Research Committee of the American Association of Textile Chemists and Colorists the following method was adopted as an A.A.T.C.C. Tentative Method:

Fastness to Atmospheric Gases of Dyes on Cellulose Acetate Rayon

A.A.T.C.C. TENTATIVE METHOD

Test Specimens: Four specimens shall be cut from the fabric to be tested. One specimen shall be washed in a soap solution (containing 5 g. of 88 per cent neutral soda soap per liter of water of approximately zero hardness) for 15 minutes at 100° F., rinsed in warm water and allowed to dry in the air. One specimen shall be immersed in cold Stoddard Solvent for 15 minutes, squeezed, and allowed to dry in the air. One specimen shall be immersed in cold perchlorethylene for 15 minutes, squeezed, and allowed to dry in the air. The fourth specimen shall be retained in its original condition.

Apparatus: The apparatus shall consist of an enclosed metal chamber, connected by a metal pipe to a lighted gas-burner in such a manner that the burnt gases from the burner pass directly through the chamber. Either natural or manufactured gas may be employed.*

Procedure: Samples of the four specimens, each measuring at least one inch square, shall be suspended freely in the chamber together with a "control sample"** of a standard acetate rayon dyeing of known sensitiveness to gas fumes. The gas burner shall be lighted, and the flame adjusted so that the temperature in the chamber does not exceed 140° F. The samples shall remain in the chamber until the "control sample" shows a change of shade corresponding in degree with that of a "standard fading."*** The samples shall then be removed from the chamber and immediately compared with the respective unexposed portions.

Evaluation: A sample which shows no alteration of shade shall be considered to have satisfactory resistance to atmospheric gases. A sample which shows as much alteration of shade as the control sample must be regarded as definitely sensitive to atmospheric gases.

*Any type of apparatus which conforms to these specifications may be used. It is strongly recommended that a motor driven fan be installed in the chamber to keep the fumes well distributed, and that a grid of iron wire be placed over the gas burner, as this will accelerate the production of oxides of nitrogen, which are responsible for the fading of the dyes. A complete description of a typical apparatus which has proven satisfactory will be published soon in the AMERICAN DYESTUFF REPORTER.

**The "control sample" shall consist of a 1 per cent dyeing of Celanthrene Brilliant Blue FFS (or its equivalent) on acetate rayon satin.

***The "standard of fading" shall consist of a silk fabric dyed with stable dyes to imitate the color of the "control sample" after it has been exposed to average atmospheric conditions for a period of six months. Samples of both the "control sample" and the "standard of fading" are available on request to C. A. Seibert, P. O. Box 386, Wilmington, Del.

PHOTOGRAPHED AT THE SOUTHEASTERN MEETING

UPPER LEFT: left to right—Samuel I. Parker, Frank L. Asbury, Jr., Hugh H. Comer, W. H. Randolph, Jr.; CENTER: left to right—R. D. Harvey, C. Russell Gill, Dr. Karl Reiland, Perrin N. Collier; UPPER RIGHT: among those in the group are: C. R. Mitchell, W. C. Gibson, Royce C. Smith; LOWER LEFT: among those in the group are: Allen Jones, John C. Turner, Geo. E. Glenn, Jr., C. K. Cobb, L. L. Jones, Jr., J. W. Richardson; LOWER RIGHT: among those in the group are: W. B. Griffin, A. J. Morse, J. C. Fonville, W. Fred Crayton, E. A. Feimster.

MEETING, SOUTHEASTERN SECTION

THE Southeastern Section held its final meeting of 1940 on Saturday evening, December 7, at the Atlanta Athletic Club, Atlanta, Ga. Perrin N. Collier, Vice-President and Director of Research, Callaway Mills, LaGrange, Ga., presided as chairman. There were 103 members and guests present; the speakers were Leslie L. Bamberger, Purchasing Agent, Lanett (Alabama) Bleachery and Dye Works, who is vice-chairman of the Section, and Dr. Karl Reiland, formerly Rector of St. George's Episcopal Church, New York City, and now a part-time resident of Lindale, Ga., where one of the plants of the Pepperell Mfg. Company is located.

This being the annual meeting of the Section, election of officers for 1941 was held. Mr. Collier and Mr. Bamberger were elected as chairman and vice-chairman, respectively, and the following three officers were also re-elected: Curt Mueller, Supt. of Dyeing and Bleaching, Bibb Mfg. Co., Macon, Ga., as secretary; A. R. Macormac, Textile Department, Alabama Polytechnic Inst., Auburn, Ala., as treasurer; and Robert W. Philip, Editor of *Cotton*, Atlanta, Ga., as councilor.

A new Sectional committee was named, consisting of the following:

George L. Dozier, Sandoz Chemical Works, Marietta, Ga.; W. B. Griffin, Kali Mfg. Co., Atlanta, Ga.; John P. Harrison, Supt., Muscogee Mfg. Company, Columbus, Ga.; W. C. Hunter, Supt. of Dyeing, Eagle & Phenix Mills, Columbus, Ga.; M. T. Johnson, Supt. Dyeing, Hillside Plant, Callaway Mills, LaGrange, Ga.; R. J. McCamy, Supt. Dyeing, Pepperell Mfg. Co., Lindale, Ga.; George E. Missbach, F. H. Ross & Co., Atlanta, Ga.; J. W. Richardson, Supt. Bleaching, Russell Mfg. Co., Alexander City, Ala.

All photos by Robert W. Philip, Editor of "Cotton."

Included in this photo are: L. L. Bamberger, Dan S. Rion, W. B. Strickland, Walter Hadley, Reid Clanton, Dr. Walter M. Scott, W. C. Gibson, J. C. Robertson, O. G. Edwards, W. C. Kirby, C. G. Stover, C. K. Cobb, Allen Jones, John C. Turner, L. L. Jones, Jr., C. R. Mitchell.

George H. Small, of National Oil Products Co., reported as chairman of the Section's delegation to the Annual Convention in New York, October 18-19. Secretary Mueller, Treasurer Macormac, and Councilor Philip reported for their offices during the year.

Dr. Reiland delivered a well-received inspirational address, and Mr. Bamberger presented for the Section the paper, "Some Observations on the Tendering of Vat and Naphthol Dyed Army Duck upon Total Exposure to Weathering," which was the Section's paper in the contest during the Annual Convention in New York. After its presentation there was considerable practical discussion of it by members of the Section.

Chairman Collier announced that he would call a meeting shortly of the officers and committee to make plans for 1941. P. G. Wear of Penick & Ford, Ltd., won a special prize as the first man to make reservation for the meeting; and Louis L. Jones, Jr., of Canton (Ga.) Cotton Mills, won the attendance prize.

Respectfully submitted,

CURT MUELLER, *Secretary.*

MEETING, NORTH CAROLINA STATE COLLEGE STUDENT CHAPTER

THE Textile School of North Carolina State College was very fortunate in having as its guest speaker on November 12, William A. Wolhar, superintendent of finishing and dyeing in the Rosemary Mfg. Co. plant at Rosemary, N. C. Mr. Wolhar gave an informal talk on screen printing, and in order that each operation in the plant could be understood better, he followed up his talk with a very informative movie which covered every phase of screen printing.

Mr. Wolhar was assisted in his discussion by three graduates of the State College Textile School who are connected with Rosemary at the present time. These men were: E. B. Manning, head designer; J. E. McGee, assistant superintendent at Rosemary, and J. E. Shaw.

Mr. Wolhar stressed the possibilities, the advantages, and the varied processes of screen printing. The movie was in technicolor and was filmed by Mr. Wolhar in the Roanoke Rapids plant of Rosemary Mfg. Co.

In replying to questions from the students, Mr. Wolhar explained how the development of screen printing would greatly reduce the import of this material and also give rise to a much needed American industry. Many interesting samples were shown at the conclusion of the movie. Mr. Wolhar sees many opportunities for greater improvements in screen printing in the future and feels that college men of today are in a better position than ever before to make changes which will be advantageous to the printing phase of textiles.

Respectfully submitted,

GEORGE W. FUNDERBUNK, *Secretary.*

ANNUAL BUSINESS MEETING
October 18, 1940

PRESIDENT DRAVES: I now call to order the Annual Business Meeting of the Association.

We shall first have a report of the proceedings of the Council by our National Secretary, Dr. Chapin.

Secretary Chapin: If you will permit me, I will dispense with the formal report at this time.

The Year Book will record the meetings of the Council. The membership of the Association, as is evident from this meeting, is steadily increasing. Last May we were able to report in the AMERICAN DYESTUFF REPORTER for the first time a membership in excess of 2,500. It is now over 2,600. (Applause.)

President Draves: It is also appropriate here to have just a word from our treasurer, Mr. Moorhouse.

Mr. Moorhouse: I am going to ask you to permit me also not to report in detail.

The last audited report which was for the year 1938 to 1939 will be published in the Year Book as well as an unaudited report which was presented to the Council today and accepted by them. (Applause).

President Draves: For the general information of our members, you might be interested to know that at the present time we continue to be in sound financial condition. (Applause.)

And now I throw the floor open to any business which any member wishes to bring before it. We believe in the practical workings of democracy; throughout the year the Council carries on the business of the society, but if anyone has anything he wants to present to the Association he may now have the floor.

If there is no business to be brought up by any member, you have at least had your opportunity; it is now in order to adjourn.

. . . A motion to adjourn was made, duly seconded, and carried . . .

. . . The session thereupon recessed at five thirty-five o'clock . . .

BY-LAWS, RULES AND REGULATIONS OF THE PIEDMONT SECTION
American Association of Textile Chemists and Colorists

(*These by-laws are published as an example of business-like conduct of Sectional affairs.*)

1. NAME. The name of this group shall be The Piedmont Section, American Association of Textile Chemists and Colorists.

2. PURPOSE. The purpose of this Section shall be to promote cooperation and understanding among those associated with any phase of the business of dyeing, bleaching, printing and finishing; to render useful service to the membership by presenting papers and discussions of problems affecting the industry; to advise the membership of new developments by securing speakers able to

present such information and by the appointment of committees to investigate and report on new ideas and developments; to encourage personal acquaintance and friendly spirit among the members of the Association; to work in close harmony and cooperation with the National Association and its objectives.

3. MEMBERSHIP. The membership shall consist of all members in good standing of the A. A. T. C. C. who are classified by the National Secretary as members of this Section.

Voting on all matters pertaining to the Section shall be by those members declared eligible to vote according to the Constitution and By-Laws of the National Association. The term "voting members," used in these By-Laws, shall refer to members of this class.

4. OFFICERS. The Officers of this Section shall be a chairman, vice-chairman, secretary, a sectional committee of four members and any other officers required by the Constitution and By-Laws of the National Association, such as councilors, members of national governing boards, national nominating committees, etc.

Officers shall be chosen from those members declared eligible to vote according to section three of these By-Laws.

No member shall hold more than one elective office at the same time.

5. ELECTION OF OFFICERS. Officers of this Section shall be elected at the fall meeting of this Section for a term of one year, in accordance with the following procedure:

A nominating committee, appointed by the chairman, shall nominate one member for each office. The Eligible voting members of the Section shall be advised by mail, at least thirty days prior to the fall meeting, of the selections of this committee. Counter nominations, signed by at least three voting members, may be filed with the secretary within a period of twenty days following notification of the selections of the nominating committee. The secretary shall mail every voting member of the Section a ballot bearing the names of all nominees for each office and an envelope in which the ballot may be placed and sealed. Ballots marked and returned to the secretary shall be opened and counted at the fall meeting by tellers appointed by the chairman. The nominees receiving a plurality of the properly marked ballots shall be declared the elected officers of the Section for the coming year.

6. DUTIES OF OFFICERS. The chairman shall preside at and determine the order of business and procedure of all meetings, appoint all committees, be a member ex-officio of all committees, and shall be responsible for the general welfare and administration of the Section.

The vice-chairman shall assume the duties of the chairman in the absence of the chairman.

The secretary shall keep all the records of meetings and members, and be in charge of general correspondence. He shall furnish the Officers of the National Association with such reports as may be required or deemed advisable. He shall be responsible for notifying the members of the dates and locations of meetings, the selections of the nominating committee, and the printing and distribution of ballots.

The treasurer shall collect all monies and pay all bills approved by the chairman and the secretary, keeping accurate records of the same. He shall furnish a report to the Section at least once in each year, and additional reports as called for by the chairman.

The sectional committee, together with the chairman, secretary, and treasurer shall constitute the governing board of the Section.

Should any office, other than that of chairman, become vacant for any reason, the governing board shall elect a voting member to fill out the unexpired term.

7. MEETINGS. At least four meetings shall be held each year.

At least two business sessions shall be held each year, one in the fall and one in the spring, at which time the officers may report the condition of the Section to the members, motions by voting members may be considered, and business concerning the Section may be discussed. Such business sessions may constitute a part of the stated meetings. As provided in section 6 of these By-Laws, the chairman shall preside at the business sessions and shall determine the order of business, propriety of motions, length of discussion, method of balloting on acceptable motions, and make such rulings as may be required. He shall be expected to preside in a fair manner and in accordance with accepted parliamentary procedure.

Twenty voting members shall constitute a quorum at any business session.

8. GOVERNMENT AND REGULATION OF THE SECTION. The governing board shall determine the number (in addition to four), the location, and dates of meetings of this Section. The governing board shall regulate the attendance at and method of conducting the meetings. It shall be responsible for and shall regulate the financial affairs and all activities of the Section not otherwise provided for in these By-Laws.

9. AMENDMENTS. These by-Laws may be amended by the following procedure:

Proposals for amendment, signed by at least twenty members, may be submitted to the secretary. Within thirty days of the receipt of such a proposal, the secretary shall mail ballots calling for a vote on the proposed amendment or amendments to the voting members of the Section. Fifteen days after the mailing of the ballots those returned shall be opened and counted. Amendments approved by a majority of the entire membership eligible to vote shall be adopted. Ballots not returned, within the specified time, shall be considered a vote against the adoption of the proposed amendment or amendments.

Repeal or modification of any section, provision, or amendment of these By-Laws shall be by the above described method.

Nothing in these By-Laws shall be construed as superseding any provision of the Constitution, By-Laws, rules and regulations of the National Association, in force at present or adopted in the future.

MEMBERSHIP APPLICATIONS

Senior

W. Donald Reid—Manufacturing Chemist, George F. Siddall Co., Inc., Cranston, R. I. Sponsors: I. W. Fallstrom, G. P. Andrew.

Q. M. Rhodes — Technical Representative, American Cyanamid & Chemical Corp., Charlotte, N. C. Sponsors: W. W. Puckett, H. W. Rose.

David S. Rosenthal—Manager, Sudamtex, Buenos Aires, Argentina. Sponsors: C. M. Robbins, W. B. DePass.

Albert Dotcop—Chemist, Marwin Dyestuff Corp., Jersey City, N. J. Sponsors: C. D. Ehrengart, L. P. Brick.

John W. Stewart—Laboratory Foreman, General Dyestuff Corp., New York, N. Y. Sponsors: C. Z. Draves, L. Fusser.

Augustus S. Wittnebel—President, Commonwealth Color & Chemical Co., Brooklyn, N. Y. Sponsors: O. W. Bertram, L. R. Fox.

Irwin Wolder—Textile Colorist, National Aniline & Chemical Co., New York, N. Y. Sponsors: W. A. Holst, Jr., K. G. Morton.

J. Rivers Adams—Div. Sales Manager, Warner Chem. Div., Westvaco Chlorine Products Corp., New York, N. Y. Sponsors: R. D. Sloan, H. E. Kiefer, Jr.

John E. Atwood—Dyer, Waldes Koh-i-Noor, Inc., Long

Island City, N. Y. Sponsors: C. C. Knights, L. H. Winnell.

Jackson J. Ayo, Jr.—Research Chemist, General Aniline Works, Inc., Grasselli, N. J. Sponsors: C. Z. Draves, H. C. Borghetty.

Barbara Bailey—Research Asst. in Home Economics, South Dakota Agric. Exper. Sta., Brookings, S. D. Sponsors: E. R. Schwarz, H. H. Broadfoot.

William Bowker—Director of Plastic Coloring, Celluloid Corp., Newark, N. J. Sponsors: T. Hirsch, R. Fitzgibbon.

John C. Broadmeadow—Head Dyer, Van Raalte Co., North Tonawanda, N. Y. Sponsors: T. T. Murphy, M. A. Cullen.

Raymond H. Drukker—Chemist and Asst. Production Manager, Standard Bleachery & Printing Co., Carlton Hill, N. J. Sponsors: C. H. Brubaker, L. Minikin.

William O. Fischer—Dyer, W. B. Place & Co., Hartford, Wis. Sponsors: D. A. Anderson, B. H. Sharman.

George E. Fogle—Dyer, Lowell Bleachery South, Griffin, Ga. Sponsors: W. F. Crayton, C. Mueller.

Freeman W. Fraim—Supt. of Dyeing and Research Director, Atlantic Rayon Corp., Providence, R. I. Sponsors: C. C. Adams, P. J. Wood.

Douglas Fronmuller—Research Asst., Institute of Paper Chemistry, Appleton, Wis. Sponsors: A. G. Alexander, L. H. Winnell.

William F. Graney—Supt. of Dyeing, Sidney Blumenthal & Co., Inc., Shelton, Conn. Sponsors: H. H. Taylor, B. Fisher.

William Horback—Color Chemist, Celluloid Corp., Newark, N. J. Sponsors: T. Hirsch, R. Fitzgibbon.

George R. Howard—Sales and Dye Application, American Aniline Products, Inc., Charlotte, N. C. Sponsors: C. B. Ordway, R. H. Smith.

Jean G. Kern—Research Chemist, National Aniline & Chemical Corp., Buffalo, N. Y. Sponsors: R. S. Lunt, G. A. Moran.

Olen Franklin Marks—Rayon Technician, American Enka Corp., New York, N. Y. Sponsors: H. Levine, B. S. Bronner.

Joseph N. Pantridge — Production Manager, Standard Bleaching & Printing Co., Carlton Hill, N. J. Sponsor: C. H. Brubaker, P. J. Wood.

Herbert E. Poore—Dyer, Chelten Dye Works, Philadelphia, Pa. Sponsors: J. C. H. Dempsey, H. C. Spatz.

Junior

Shailer Bass—Director of Tech. Research, Cellulose Products Lab., Dow Chemical Co., Midland, Mich. Sponsors: W. A. Stringfellow, H. J. Rupright.

Robert C. Bogle—Apprentice, American Thread Co., Fall River, Mass. Sponsors: L. B. Coombs, C. W. Jackson.

Eldridge K. Camp — Dyer, Collins & Aikman Corp., Manyunk, Pa. Sponsors: C. T. Wagner, Jr., F. R. Hutt.

Otto Charles Elmer—Asst. Dyer, Cooper & Kanversy, Providence, R. I. Sponsors: D. C. Hardman, P. A. Rioles.

K. P. Ferguson—Textile Colorist, du Pont Co., Tech. Lab., Wilmington, Del. Sponsors: C. A. Seibert, C. A. Sylvester.

John A. Harley—Textile Colorist, Ciba Co., Inc., New York, N. Y. Sponsors: G. Walsh, R. Geering.

Donald B. Keefer—Dye Foreman, Wilknit Hosiery Co., Greenfield, Ohio. Sponsors: H. Waffenschmidt, R. B. Child.

Fred A. Lyon—Laboratory Asst., Rohm & Haas Co., Philadelphia, Pa. Sponsors: S. N. Glarum, J. W. Stallings.

George R. Murphy, Jr.—Asst. Dyer, Asheville Cotton Mill, Asheville, N. C. Sponsors: J. L. Crist, L. G. Atkins.

John W. Place, Jr.—Chemist, U. S. Finishing Co., Norwich, Conn. Sponsors: W. H. Cady, G. F. Walz.

J. Joseph Shedko—Research Chemist, Kearny Mfg. Co., Kearny, N. J. Sponsors: H. Ehrhardt, E. E. Wild.

Associate

Harry S. Drum—Machine Manufacturer, Smith Drum & Co., Philadelphia, Pa.

Student

George Brandt—North Carolina State College. Sponsor: A. H. Grimshaw.

Arthur W. Powell—North Carolina State College. Sponsor: A. H. Grimshaw.

Roy Garvin Buck—Lowell Textile Institute. Sponsor: L. A. Olney.

Walter Lisien—Lowell Textile Institute. Sponsor: L. A. Olney.

William Philip Camp—Alabama Polytechnic Institute. Sponsor: A. R. Macormac.

Gordon E. Wood—Alabama Polytechnic Institute. Sponsor: A. R. Macormac.

Richard A. Ewing—Philadelphia Textile School. Sponsor: E. C. Bertolet.

William A. Hoffman—Philadelphia Textile School. Sponsor: E. C. Bertolet.

Stephen F. Lehman—New Bedford Textile School. Sponsor: F. E. Busby.

William Marcellino—New Bedford Textile School. Sponsor: F. E. Busby.

Armand A. Poitras—New Bedford Textile School. Sponsor: F. E. Busby.

TRADE NOTES • NEW PRODUCTS

• TALK AT PHILADELPHIA

"Chemistry of the Surface Active Substances" was the subject of Dr. Hugh H. Mosher, head of the Research Department of the Onyx Oil & Chemical Company, Jersey City, N. J., in a talk given before a group of forty students at the Philadelphia Textile School, on December 4th.

• RHOPLEX RESINS

Rohm & Haas Co., Inc., have recently issued a booklet entitled "RHoplex Resins for Fabric Finishing," which brings up-to-date the information on these products. The booklet defines a resin, discusses the versatility and general properties of the RHoplex resins and elaborates upon their toughness, clearness and flexibility. It is indicated that RHoplex resins give fabrics improved abrasion resistance, increased tensile strength and will not be removed readily by any standard dry-cleaning or washing operation. The choice of solvents and plasticizers, preparation of the mix, and method fabric impregnation are also discussed as well as applications of RHoplex resins. Copies of the booklet are available upon request.

• GENERAL RELEASES

General Dyestuff Corp., 435 Hudson Street, New York, N. Y., announces release of circulars describing the following products:

Supramine Red BBLA—an acid color representing a new addition to the line of Supramine Colors. It is suitable for application on the various forms of wool and is particularly recommended by the manufacturers for the dyeing of knitting and hosiery yarns, and of articles which must possess good fastness to washing and light. The product is dischargeable to a clear white with Rongalite C. Circular G-207.

Benzoform Rubine BA—a direct dyeing color recommended by the manufacturers for use on cotton and, particularly, on rayon. When aftertreated with formaldehyde and acetic acid in the way usual for Benzoform Colors, it produces bluish shades of red said to be of comparatively good fastness to washing, water and perspiration. It is stated that this product is well adapted for the dyeing of materials which require fastness to wet processing beyond that obtainable with ordinary direct colors. The addition of bichromate to the formaldehyde bath has no effect on either shade or fastness. Copper sulfate does not increase the light fastness and renders the shade duller and considerably bluer. It is of good dischargeability, leaves acetate rayon effect threads practically white, stains acetate rayon surfaces slightly and silk effects considerably. Circular G-206.

• TRENDS

Copies of *Trends*, a new publication of the duPont Textile Service Section, 40 Worth Street, New York City, have recently been distributed. The publication is designed to keep retailers posted on new developments in dyeing and finishing and finding wider use for those of established merit. The hope is expressed that it will assist all those who are concerned with fabrics, constantly pointing toward greater value and serviceability An introductory statement points out that "the amazing array of new fibers, new fiber combinations, new fabrics and new finishes which have appeared in the past few years have bewildered buyer and seller alike Your customer, the consumer, has been faced with the problem of either acquiring a new fund of technical knowledge or adopting new shopping practices. The latter show up in returns and complaints, and in many cases, in withdrawal of assurances and guarantees on the part of the store." To correct this situation it is indicated that "the retailer must have proper information to select the best values, to translate consumer needs into influence on manufacturers, and to do a positive, prestige-building job in serving the public."

Contents of Vol. 1, No. 1, for December, 1940, are described by the following titles: The Call for Color; What Is Known About Color Fastness; New Film Available; Gleanings; Keeping Up with Zelan.

• JOINS ARIDYE

W. Hansot, formerly associated with various advertising and merchandising organizations in this country and in France, has joined Aridye Corporation, Fair Lawn, N. J., in a merchandising capacity.

It was announced that the fine tonal gradations and the sharp definition of detail which Aridye printing permits, plus new, more brilliant Aridye Colors, offer a broader range of opportunities to the textile designer. Mr. Hansot's experience in the style merchandising field will be applied to promoting these Aridye styling possibilities.

• A. S. A. OFFICERS

R. E. Zimmerman, vice-president of the United States Steel Corporation, was elected president of the American Standards Association at the recent annual luncheon meeting held at the Hotel Astor, New York. Mr. Zimmerman has served as vice-president of the Association since 1938, and has been a member of the Board of Directors since 1937, when he was nominated for membership by the American Iron and Steel Institute. Mr. Zimmerman is well-known both in industrial and educational circles. He is a member of the Metallurgical Advisory Board; the Carnegie Institute of Technology; Trustee of Hood College; and member of the Corporation of the Massachusetts Institute of Technology.

Mr. Zimmerman will succeed Edmund A. Prentis of the firm of Spencer, White, and Prentis, who has served as president of the American Standards Association for the past two years.

R. P. Anderson of the American Petroleum Institute was re-elected chairman of the Standards Council which is in charge of all ASA technical work. Dr. Anderson has taken an outstanding part in developing standardization in the petroleum industry. He has been a member of the ASA Standards Council since 1934, as a representative of the American Petroleum Institute. This is his second term as chairman of the Standards Council.

• BULLETINS ON CREASEPROOFING

Two Technical Bulletins, Nos. 552 and 558, on the use of Aerotex Cream No. 450 for creaseproofing are currently being distributed by the Calco Chemical Division, American Cyanamid Company.

These two bulletins have been prepared to meet a wider demand for information on creaseproofing. Following the lead of some of the large finishers, others have discovered that many fabrics are rendered more salable by the application of a creaseproofing finish. It is stated that department stores and other retail outlets are finding an increased demand on the part of the consumer for material treated in this manner. This pressure has been felt particularly with such materials as spun rayons, spun rayon and cotton, spun and acetate rayon, spun rayon and wool, cotton voile and linen.

According to Calco's Technical Bulletin No. 558, Aerotex Cream No. 450 can be applied to all of these fabrics. This same bulletin describes in detail suggested methods of applying this creaseproofing compound.

Technical Bulletin No. 552, a companion publication, lists the dyes which may be used with Aerotex Cream No. 450. It explains how various dye properties are affected by the application of creasproofing. This discussion includes testing methods for acetate dyestuffs as well as direct, sulfur and vat dyes.

Copies of this material on creaseproofing with Aerotex Cream No. 450 may be had upon request. Inquiries should be addressed to Calco at Bound Brook, New Jersey.

• ONYX SOUTHERN OFFICE

Announcement has been made of the opening of the new southern office by Onyx Oil & Chemical Co., Jersey City, N. J., at 121 West 3rd Street, Charlotte, N. C. E. W. Klumph will be in charge and will be assisted by Cliff Myers and Cliff Smith. It is stated that this new office, with enlarged facilities, was necessitated by increased southern business.

• TALK ON MACHINERY

On Wednesday, December 11th, the senior and junior classes of the Philadelphia Textile School enjoyed an illutrated talk given by W. A. Taylor, of the Textile Finishing Machinery Co., Providence, R. I., who was accompanied by E. E. Ingalls, sales representative for the New York, New Jersey and Pennsylvania area. Illustrations of printing and finishing machinery were shown and the subject discussed in all its phases.

• PHOENIX RELEASES

Phoenix Color & Chemical Co., Inc., 24 Van Houten St., Paterson, N. J., have released the following new products:

Benzaphen Yellow 6GCW—a direct color which leaves acetate white. It is recommended by the manufacturers for dyeing cotton, rayon, and rayon and acetate combination cloth. It dyes mercerized cotton substantially the same shade as rayon, making it of interest for hosiery dyeing.

It is stated that this product is greener and brighter than Fast Light Yellow 4GL. It is said to be very fast to washing and fast to acid and ironing and to have moderate to fair light fastness.

Phenaldehyde Black GR 200%—a direct color said to be rendered extremely fast to washing by the usual method of formaldehyde aftertreatment. It is recommended for the dyeing of cotton and particularly of rayon. This product is manufactured with intermediates which are said to be purified prior to coupling. It is stated that, in consequence, an exceptionally white discharge is obtained as well as a full bloomy black which does not bronze even when dyed in heavy shades. It is also said to be fast to hot ironing, acid and alkali.

Benzaphen Diazo Red 5BL—a diazo dyestuff recommended for the dyeing of rayon and cotton. It is claimed that it is slightly bluer than currently existing prototypes but has better dischargeability. It is said to be fast to washing, acid and alkali, comparatively fast to light and to level off and penetrate well.

CORRECTION

In the article "Rayon Dyeing and Finishing" by E. Hazeley appearing on page 633 of our November 25th, 1940, issue, it was erroneously indicated that this was an address of Courtaulds (Canada) Limited. It has been brought to our attention that Mr. Hazeley, who is manager of Courtaulds (Canada) Limited, gave this address as a private, rather than as a company, contribution.

BOOK REVIEW

Year Book, American Association of Textile Chemists and Colorists, *Vol. XVII, 774 pages,* 1940 *Edition.*

Part I of this publication contains a list of National and Sectional Officers, Standing Committees, Research Committees and reports of meetings covering both the annual national meeting and Sectional meetings.

Part II contains reports of the past year's accomplishments of the Research Committee and its thirty-three Sub-Committees. Several new Committees have been added since publication of the 1939 Year Book. They are: Committee on Standardization and Interpretation, Committee on Atmospheric Fading of Dyed Acetate Rayon, Committee on Mothproofing, Committee on Fireproofing and Committee on the Tabulation of Fundamental Properties of Textile Fibers.

Part III lists the Standard Methods for Determining the Fastness of Dyestuffs on the Fiber. Many of these tests have been revised in light of new knowledge of the problems involved and two new tentative tests have been added, one for Mothproofing and one for Transference of Color.

Part IV, containing lists of Dyestuffs and Textile Chemical Specialties has been extended to cover new products and will no doubt continue to be very useful.

Part V consists of the Membership list given alphabetically as well as geographically.

Copies of this publication may be obtained from Dr. Harold Chapin, Secretary of the A.A.T.C.C., Lowell Textile Institute, Lowell, Mass., at nominal cost to non-members.

• CLASSIFIED • ADVERTISEMENTS

POSITION WANTED: Chemist to supervise the dyeing and processings of rayon, acetate, cotton, also of Lastex fabrics—can take charge of chemical control, improvements, economy and research. Experience with leading organizations. Write Box No. 268, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

WANTED: Experienced ribbon dyer familiar with rayon and cotton, skein work, with all types of colors. Write Box No. 275, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

WANTED: SPECIALTY SALESMEN OR REPRESENTATIVES—Coast-to-Coast—To sell established line of synthetic detergents and textile finishes—to jobbers, chemical manufacturers and textile mills. Exceptional commission basis. Protected territory. Only men with chemical experience and following need apply. Box No. 279, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

WANTED: TEXTILE CHEMIST—Permanent position for graduate chemist, chemical engineer or equivalent. Should have experience in analysis of textile chemicals and dyes, also their application to textiles. Must be native born American citizen. State age, religion, experience and salary desired. Our employees know of this vacancy. Box No. 280, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

THIS MONTH

We Lay off That 'Stuff...

For the past eleven months we've been preaching Dyestuffs—and CIBA, of course.

But a glimpse at our desk calendar shows we're down to the last month of the year and Christmas is practically in our midst.

So, at this Merry Christmassy time of year we'll lay off the sales talk and say a bit regarding—

Plum Pudding and Prosperity to all our good friends and customers for the coming year.

We want to take this opportunity to thank you for the confidence you have placed in us, and for your loyalty to us . . . and here's a toast:

May our friendship through the New Year ring as true as through the last . . . our ambitions just as sincere in the future as in the past.

And to this toast we've given, may we stop to add: "May you have the joy of living the best year you've ever had."

Cordially yours,

THE CIBA COMPANY

A Four Days' Investment In Future Business!

the 37th Annual

KNITTING ARTS EXHIBITION

COMMERCIAL MUSEUM • PHILADELPHIA

APRIL 21, 22, 23, 24

UNDER AUSPICES OF THE NATIONAL ASSOCIATION OF HOSIERY MANUFACTURERS AND UNDERWEAR INSTITUTE

There has NEVER been a time when so much mutual benefit can result from a meeting of producers and buyers in the knit goods trade. Expansion is going on everywhere—employment is up—payrolls are up—the hosiery and underwear industry is building, not merely to meet present requirements—but for the future.

This Is The Year's ONLY Opportunity For Producers of

Knitting Machinery
Dyeing Machinery
Drying Machinery
Winding Machinery
Throwing Machinery
Sewing Machinery
Preboarding Machinery
Hosiery Repair Machinery
Inspection Equipment
Building Equipment
Boxing and Packing Supplies
Air Conditioning Equipment
Electrical Equipment
Testing Equipment
Office Equipment
Yarns of All Kinds
Chemicals, Oils and Soaps
Mill Supplies and Allied Products

—to Meet and SELL

Company Executives
Mill Officials
Sales Managers
Financial Representatives
Purchasing Agents
Key Men in All Branches

It is certain that 1941 will see more replacements, more changes in equipment than ever before. That's why it's essential EVERY manufacturer of EVERYTHING in the hosiery and underwear industry should exhibit.

The price of a space 100 square feet is only $150, including backwall, side partitions, desk, chairs, rug, hat tree and booth sign—and also electricity or steam, if required.

MAKE YOUR SPACE RESERVATIONS TODAY!

WIRE, 'PHONE OR WRITE

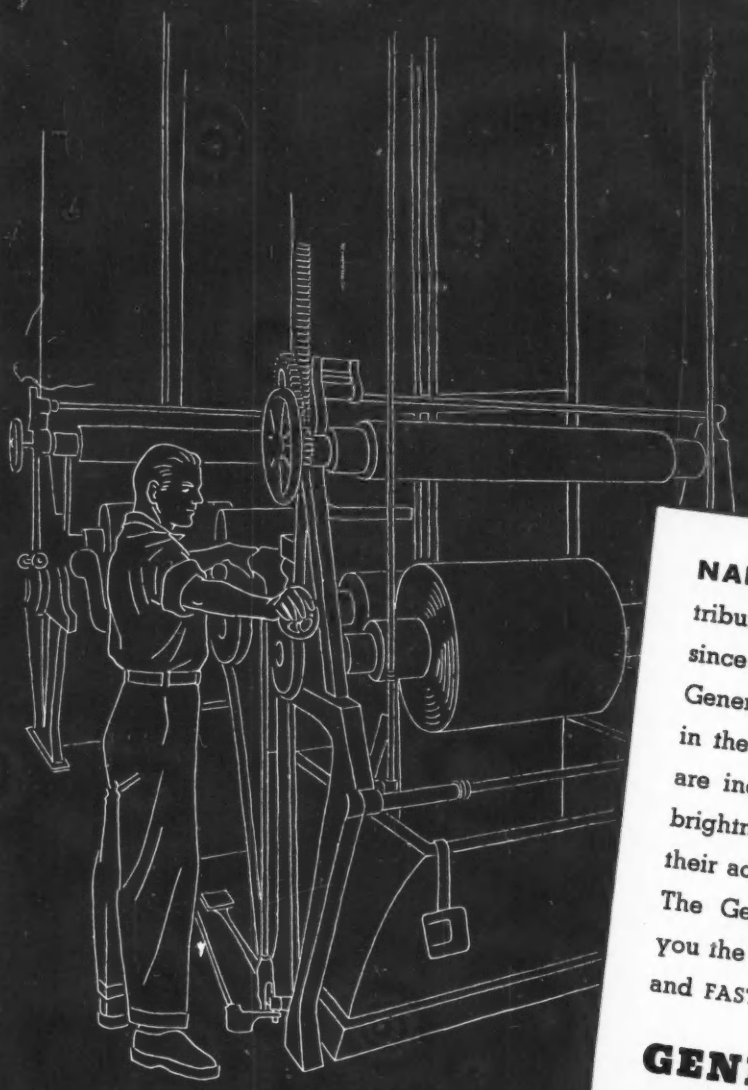
ALBERT C. RAU, *Manager*

KNITTING ARTS EXHIBITION

925 PARK SQUARE BUILDING **BOSTON, MASS.**

Telephone HANcock 8996

NAPHTOLS



NAPHTOLS are the most important contribution to the art of dyeing and printing since the introduction of vat colors. The General Dyestuff Corporation is the pioneer in the NAPHTOL group of dyestuffs, which are increasingly popular because of their brightness of shade, fastness, low cost and their adaptability to many types of fabrics. The General Dyestuff Corporation offers you the most complete range of NAPHTOLS and FAST COLOR SALTS available.

GENERAL DYESTUFF CORPORATION

435 HUDSON STREET, NEW YORK, N. Y.

Boston, Chicago, Charlotte, Philadelphia, Providence, San Francisco

CELUTATE
BRILLIANT BLUE B

for Acetate Rayons

Very brilliant as a self shade and suitable as a base for bright greens.

Remarkable for its building up properties and its fastness to rubbing in heavy shades.

"CELUTATE" — Registered Trade Mark.

ZINSSER & COMPANY, Inc.
ESTABLISHED 1897
Manufacturing Chemists
HASTINGS-ON-HUDSON NEW YORK

BIXACID FAST RED GL
FOR
WOOL

This level dyeing wool color is *faster to light* than any other Acid Red. Its good money value renders it of special interest for the production of fast to light Reds, or in combination with Alizarine Blues and Fast Light Yellows for the production of mode shades.

Send for product sample and price

BICK & CO., Inc.
Manufacturing Chemists
Reading, Pa. Charlotte, N. C.

5 Lixate installations in 5 plants in 5 years by Allied Textile Printers, Inc.

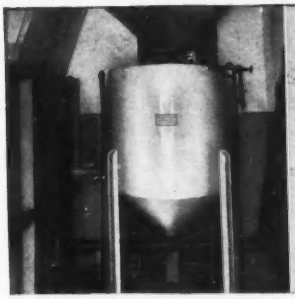
ILLUSTRATED on this page are the five Lixate installations made during the past five years by one of America's leading textile printing companies. These five installations supply Lixate Brine for discharge dyeing and for regenerating zeolite water softeners, in no less than six different divisions of this company's wide-spread business.

This is an outstanding example of one of the most convincing endorsements of The Lixate Process by many industries. That is the way in which the original Lixate installation in one plant, leads to more installations in other plants or divisions under the same management—and even additional installations in the original plant for other uses.

In the textile industry, Lixate Brine helps to improve quality by more level dyeing—guards against streaks, spots and whitened edges. It is a great convenience, as it eliminates all the fuss and nuisance of trucking or carrying bags and boxes of salt, or tanks and barrels of brine through the mill. It speeds up wet processing operations. Yet all of these advantages are gained with 4 major savings in operating costs:

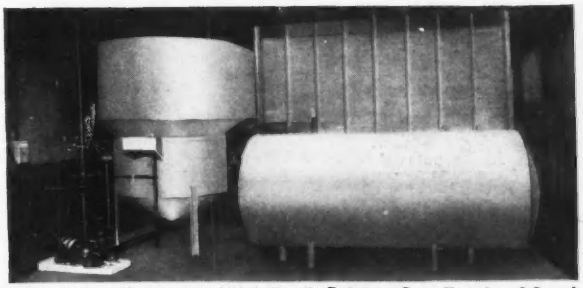
1. Lower labor cost for handling salt.
2. No labor or power cost for making brine or mixing a saline exhausting agent in the dye bath.
3. Reduced mill distribution costs, as brine can be piped to points of use eliminating the cost of distributing solutions or salts by hand through the mill.
4. Savings of 10% to 20% in amount of salt required.

All of these advantages are due to the automatic production of a fully saturated, crystal clear brine, from International's Rock Salt. The brine produced is bacteriologically clean, and chemically pure far beyond the pure food requirements. For a detailed explanation of the Lixate operation, write for a copy of The Lixate Book, which contains pictures of many installations, and detailed data about the properties of salt brine.

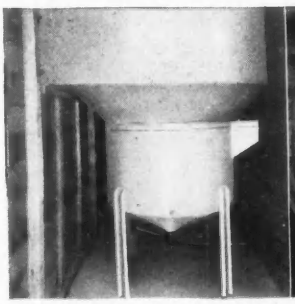


● *Lixate installation for Allied Textile Printers, Inc., Perennial Division, West Warwick, R. I.*

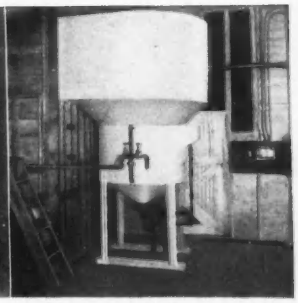
● *Lixate installation for Allied Textile Printers, Inc., International Division, Paterson, N. J.*



● *Lixate installation for Allied Textile Printers, Inc., Regal and Standard Divisions, Paterson, N. J.*



● *Lixate installation for Allied Textile Printers, Inc., Printex Division, Paterson, N. J.*



● *Lixate installation for Allied Textile Printers, Inc., Opal Division, Haledon, N. J.*

● SALT FOR EVERY PURPOSE

International Salt Company, Incorporated, developed The Lixate Process in order to help industry use salt better and for greater profit. International produces all types and grades of salt for every industrial use, including all grades of granulated salt (vacuum evaporated); flake salt (grainer evaporated); and Rock Salt. The advice and counsel of The Research Department of International Salt Company, Incorporated, is offered freely and without obligation to all industrial users of salt or salt brine.

● WRITE FOR THIS BOOK

The Lixate Book will be sent free on request. It not only describes The Lixate Process and illustrates many installations, but it also gives valuable information about salt brine. The International Brine Table alone would make this book a worth while addition to the technical library of any textile executive.

The LIXATE *Process*
REG. U. S. PAT. OFF.
for making brine

INTERNATIONAL SALT COMPANY, Inc., SCRANTON, PA.

SALES OFFICES: *New York, N. Y. • Buffalo, N. Y. • Philadelphia, Pa. • Boston, Mass. • Baltimore, Md. • Pittsburgh, Pa. • Newark, N. J. • Richmond, Va. New Orleans, La. • Cincinnati, O. • St. Louis, Mo.*

REFINERIES: *Watkins Glen, N. Y. • Ludlowville, N. Y. • Avery Island, La.* • MINES: *Retsof, N. Y. • Detroit, Mich. • Avery Island, La.*

As Self Color or in Combination

Indigosol

Brown IBR

INDIGOSOL Brown IBR is a reddish Brown of excellent fastness properties; readily soluble and easily developed.

It is especially suitable for padding and dyeing, and in combination with Indigosol Golden Yellow IRK, Indigosol Olive Green IB or Indigosol Blue IBC, gives Tan, Drab and Khaki shades of a high degree of all around fastness.

The ease of application, perfectly level shades obtained, and excellent penetration of heavy goods make it one of today's most valuable colors for the fast color dyer or printer.

For Printing Delustered Rayons

Pharmasols

A NUMBER of practical tests recently completed demonstrate that excellent results are obtained from the use of PHARMASOLS in the printing of delustered rayons, excepting acetate rayons.

The shades obtained are full and bright, perfectly level and of excellent fastness.

Blotches as well as small objects can be printed.

PHARMASOLS are solutions of stabilized azoic dyes and adjusted to the most practical concentration. Their ease of application and maximum of efficiency make PHARMASOLS the stand-by of every progressive printer.

The problem of troublesome dissolving and the uncertainties thereof are eliminated—and as there is no decomposition there is no loss of material or value.

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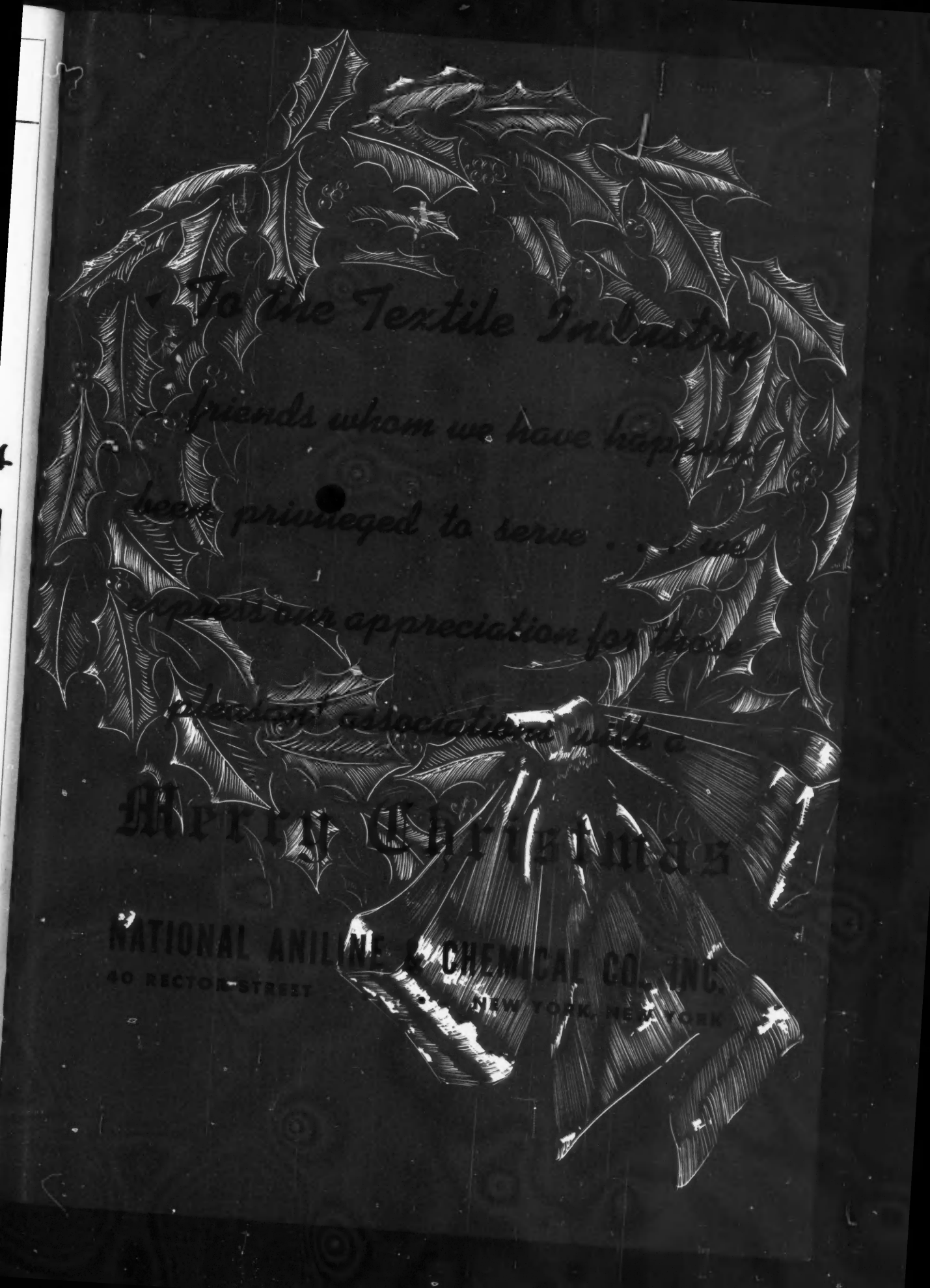
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friends whom we have hoped to
have privileged to serve . . . we
express our appreciation for these
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OUR DYER COULDN'T BUDGE THE TRANSFER ...TILL HE TRIED

Laureltex **#340**

So writes one customer. Then this lot of silk hosiery was on its way to stripping, re-dyeing and profit . . . Laureltex #340 removes all kinds of transfers, even the stubborn ones. Easy to use, efficient, economical . . . Clean up your discontinued numbers and eliminate inventory losses. Laureltex #340 will help. Send for sample and directions for use today.

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New York's Popular
HOTEL LINCOLN
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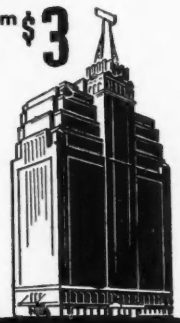
OUR CHOICEST ROOMS From $3

1400 ROOMS each with Bath, Servidor, and Radio. Four fine restaurants acclaimed for cuisine.



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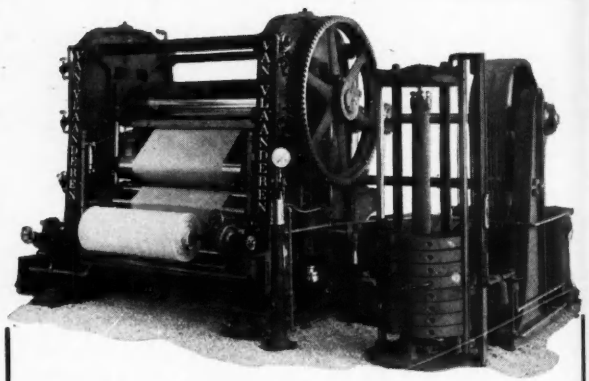

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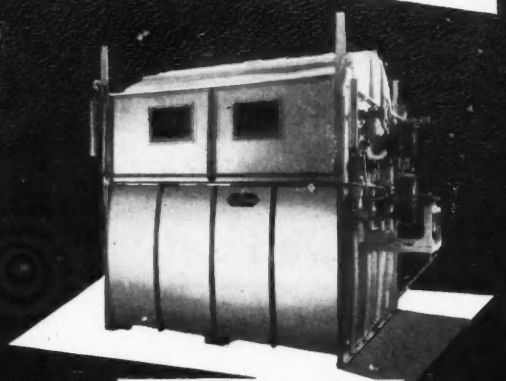

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